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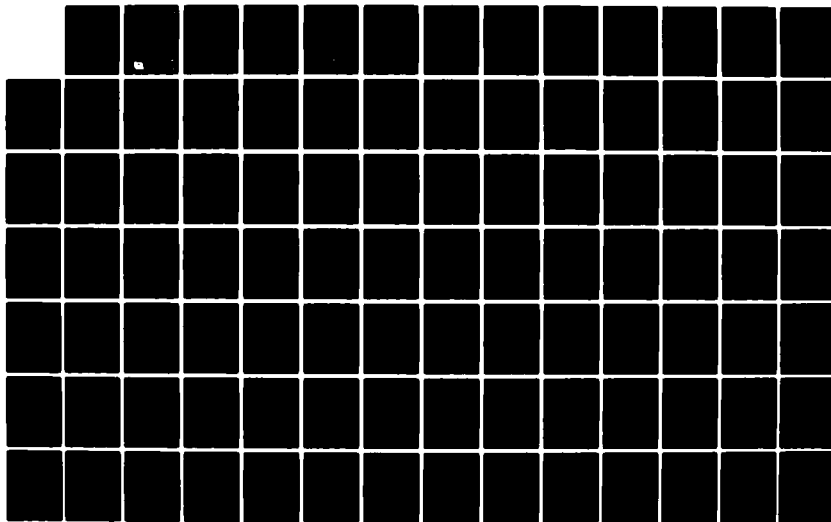
ALTERNATIVE METHODS FOR THE ANALYSIS OF LEASE/PURCHASE  
OPTIONS IN NAVAL A..(U) INSTITUTE FOR DEFENSE ANALYSES  
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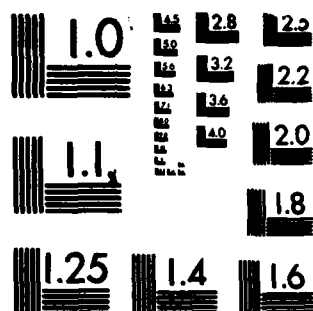
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IDA PAPER P-1665  
(Revised)

ALTERNATIVE METHODS FOR THE ANALYSIS OF  
LEASE/PURCHASE OPTIONS IN  
NAVAL AUXILIARY SHIP ACQUISITION

John D. Wells  
Paul G. Munyon

November 1983

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*Prepared for*  
Office of the Under Secretary of Defense Research and Engineering

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## PREFACE

The research for this paper was conducted by the Institute for Defense Analyses (IDA) for the Under Secretary of Defense for Research and Engineering (USDR&E) under Contract No. MDA 903 79 C 0018, Task Order T-3-158, as amended. The objective of the research was to examine the issue of leasing Naval auxiliary ships as an alternative to purchasing the ships, with particular attention being paid to relative costs.

At the beginning of the research, very little formal attention had been given to the issue. However, a methodological controversy developed when, during the course of this study, 13 cargo ships (TAKXs) for the Navy's Maritime Prepositioning Ships Program were procured under a time-charter arrangement involving leveraged-leasing. The staff of the Joint Committee on Taxation criticized the Navy's method of accounting for Government costs, which was similar to the method we used in earlier versions of this paper. More recently the General Accounting Office criticized both the Navy and IDA costing methods, particularly with respect to the discount rate used in both studies.

As a result of the controversy, we re-examined our methodology for calculating Government costs. We found that the controversial issues do not actually relate to the methodology per se but in the assumptions used for the input values required by the method, and the results are particularly sensitive to the discount rate assumption. We noted that the sensitivity analyses in the earlier versions of

our paper needed to be expanded. In addition, we saw the need to explore other Government cost methodologies which might be less sensitive to input assumptions.

As a consequence of this additional research, we made substantial revisions in the earlier paper, especially with respect to the chapters dealing with the costs of leasing to the Navy and to the Government as a whole. We expanded our discussion of discount rates and introduced an alternative method for estimating Government leasing costs. The earlier versions of this paper, therefore, are obsolete in detail, although we have concluded that the general conclusions reached in those versions are still valid.

Technical cognizance for the research was provided by OUSDRE/Naval Warfare. We wish to express our appreciation to Mr. John P. McGough of that office for his valuable assistance and cooperation throughout the study period.

We also wish to express our gratitude to the following individuals for their valuable contributions:

- Dr. D.C. Dacy
- Dr. R. Kuenne
- Dr. J.A. Stockfisch
- Dr. R.W. Thomas

Drs. Stockfisch and Thomas, in particular, assisted in the general development of the new costing method. The detailed development and application of this method is, of course, the responsibility of the authors.



## **EXECUTIVE SUMMARY**

### **THE PROBLEM**

The Navy's desired buildup of surface and submarine forces could require financial resources well above anticipated budget authorizations. The possible funding shortfall presents the Navy with the problem of how to achieve a balanced ship acquisition schedule. High priority combat ships are being procured, but auxiliary ships to support battle groups must also be acquired. Fleet effectiveness could be affected if the proper balance of combat and support ships is not achieved.

### **STUDY PURPOSE<sup>1</sup>**

The purpose of this study is to explore alternative methods of financing the acquisition of naval ships and to determine costs to the Navy and to the Government as a whole under various economic criteria.<sup>2</sup> Specifically, this study examines the build-and-lease (charter) option for acquiring

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<sup>1</sup>Appendix A contains the text of the Task Order for the study.

<sup>2</sup>Costs to the Navy and to the Government as a whole differ because of tax writeoff effects on Treasury income which are not felt by the Navy.

naval auxiliary ships as an alternative to purchasing the ships.<sup>1</sup>

## **BACKGROUND**

### **1. Precedents and Options for Leasing Naval Ships**

The Navy's Military Sealift Command (MSC) has regularly chartered existing commercial ships for the transport of military supplies, and it has also used build-and-lease programs for acquiring transport ships. For example, in 1972 the Navy entered into a long-term (20 year) leasing arrangement to acquire nine new tankers. During the course of this study (1982-83) the Navy awarded contracts to build- or convert-and-charter 13 TAKX cargo ships. These ships are to be acquired for the Maritime Prepositioning Ships (MPS) program to provide prepositioned supplies for support of three Marine Amphibious Brigades.

### **2. Leveraged Lease Concept**

Both of the programs described above used the "leveraged lease" concept as the basis for the lease. Under this concept, private sector interests arrange for the construction and the long-term financing of the ship. The Navy promises to lease the ship when it is built, tested, and delivered to the private owners. Although other parties may be involved in the leasing process, three primary parties are always present:

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<sup>1</sup>Although there are technical differences, the terms "lease" and "charter" are used synonymously unless otherwise noted. The Glossary presents definitions for these and other technical terms.

1. The lessors (equity owners), who purchase the ships from the shipbuilders and lease them to the ship operators or directly to the Navy.
2. The lenders (long-term debt holders).
3. The lessee (ship operators/Navy).

The modifier "leverage" is used to describe the procedure whereby the lessors (equity owners) supply only a fraction, usually 20 to 50 percent, of the acquisition cost of the ship and obtain a long-term loan for the remainder. The "leverage" comes from the fact that the lessors, as owners of the ship, obtain all of the tax shelters; i.e., they may deduct the following from taxable income:

- Interest on long-term debt.
- Depreciation under the Accelerated Cost Recovery System.
- Other deductible expenses.

In addition, the Investment Tax Credit (ITC) of ten percent of the (IRS-defined) allowable capital cost of the ship may or may not be available to the owners depending upon the nature of the lease contract. The ITC could be deducted directly from the income tax liabilities of the lessors during the first year of the lease. The Accelerated Cost Recovery System (ACRS) and interest expense deductions also may amount to significant amounts during the early years of the lease. Under current tax laws, a ship qualifies as five-year property so that ship's allowable capital cost may be deducted from income during the first five years.

The significance of these tax benefits to the Navy is that the lessors may "pass through" to the Navy, by way of

lower lease payments, a large portion of the tax benefits.<sup>1</sup> This pass-through is accomplished when the after-tax rate of return on the lessor's equity contribution is fixed and a lease payment stream is determined such that the lessor's discounted net cash flow from those lease payments yields the lessors' selected rate of return. The lease payment, therefore, will vary according to the level of tax benefits available. The greater the tax benefits, the lower the periodic lease payments to the lessor need to be in order to obtain the given rate of return. These tax benefits, however, are costs to the Government (Treasury). They may or may not be recaptured in subsequent years through income taxes, depending upon the tax postures of the participants in the leasing arrangement.

### **3. Influence of Tax Benefits on Contracting Procedures**

As indicated in Table S-1, whether or not the lessors can use the Investment Tax Credit (ITC) and other tax shields has an important bearing on the size of the periodic lease cost. For a \$100 million ship and a mortgage percent of 50 percent (equity = 50 percent) and an equity holder's after tax rate of return of 12 percent, the annual lease payment would be \$9.5 million with the ITC and \$11.3 million without the credit. The undiscounted total cost to the Navy of the 25-year lease would be \$236.6 million with the credit versus \$283.1 million without it, a difference of \$46.5 million.

According to current tax laws, if a lease is made directly to a Federal Government agency, the lessor may not

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<sup>1</sup>Current tax guideline (Rev. Procedure 75-21) and the structure of the nonrecourse debt may limit the amount of tax benefits that can be passed through to the lessee. See page 2-5 for a detailed explanation.

Table S-1. EFFECT OF INVESTMENT TAX CREDIT (ITC) ON  
LEASE PAYMENTS AND TOTAL LEASE COST

\$100 Million Ship; 12 Percent Mortgage  
Rate<sup>1</sup>

(Dollar Figures in Millions)

Mortgage Percent	Annual Lease Payment		Total Lease Cost (25-Years)	
	With ITC	Without ITC	With ITC	Without ITC
50	9.5	11.3	236.6	283.1
60	8.6	10.4	214.3	260.8
70	7.7	9.5	192.0	238.5
80	6.8	8.6	169.7	216.2

<sup>1</sup>See Table 3-1 for other input values used in the lease  
calculations.

take the Investment Tax Credit. However, under the recent TAKX procurement, the Navy appears to have found a way to obtain the full list of tax benefits. The procedure involves the standard time-charter arrangement of chartering the space on the ships from ship operating companies. Under a time-charter arrangement, the charterer (here the Navy) will contract with the operators for the latter to crew, navigate and maintain the time-chartered ships. In the TAKX procurement the operating companies are required to:

- Arrange for the construction or conversion of the ships;
- Find purchasers (equity owners) of the ship and then "bareboat" lease the ship from the equity owners; and
- Arrange for the placement of long-term mortgage bonds for the portion of the capitalized cost not covered by the equity owners.

The Navy has no financial interest in the ships nor does it have control over their day-to-day operation and maintenance except to designate the location of the ship, the use to be made of the chartered time and space, and to set maintenance standards. However, the Navy does maintain control over the cargo and over certain cargo handling and military equipment.

#### 4. Ship Acquisition Funding

It is important to recognize that the funding of ship leasing programs comes from the Navy's O&M appropriations. Specifically, leasing (chartering) programs are handled through the Military Sealift Command (MSC), which is an activity under the Navy Industrial Fund (NIF). Lease obligations (e.g., a five-year commitment to lease) involve a commitment of the unobligated balance of the NIF, and the amount that can be obligated for the leasing program is constrained by the level of this balance. Under current law,

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- A schematic diagram of a 1D lattice chain. It consists of a horizontal line with several dots representing lattice sites. The sites are connected by horizontal lines, indicating nearest-neighbor interactions. Some sites are labeled with '1' and '2'.

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Figure 1: A schematic diagram of a 1D lattice chain. It shows a horizontal line with several dots representing lattice sites. The sites are labeled with '1' and '2' at the ends, and 'N' in the middle. Arrows indicate nearest-neighbor interactions between adjacent sites. The diagram is labeled 'Figure 1' at the bottom.

easily calculated and are therefore not included in Navy budget estimates. The Government, however, must consider not only the direct costs of leasing or purchasing but also the net effects of financing costs and tax losses or gains to the Treasury.

Two methods for calculating Government costs have been used. The first (Method I) accounts for all cost flows involved in the lease transaction. The second (Method II) takes the "tax subsidy" approach which is designed to explore the effects on the Treasury of special tax measures such as the Investment Tax Credit and/or accelerated depreciation.

## CONCLUSIONS

### 1. Lease Versus Purchase Costs

#### a. The Navy's Viewpoint

- (1) For the Navy, the key issue in the lease versus purchase trade-off is: which appropriation accounts should be used for the acquisition of the ship. Because Government financing costs and net tax effects are not accounted for in these appropriation accounts, the Navy does not attempt to include such costs in its lease/purchase cost analysis; i.e., only the direct and contingent costs of leasing or purchasing which would have an effect on the Navy's budget expenditures are considered to be appropriate. The lease payment stream is adjusted for inflation but is not discounted to account for Government finance costs. Except when the expected inflation rate is high (greater than five percent), the inflation-adjusted direct cost (exclusive of financing costs, tax effects and contingent costs) of leasing a ship will exceed the direct cost of purchasing the ships. Therefore, the Navy's lease versus purchase decision normally reduces to one of deciding whether paying the higher lease costs out of Operation and Maintenance appropriations over a long period of time is worth the savings it would obtain for the Ship Construction and Conversion (SCN) appropriations.



- (2) Contingent costs should be an important element in the Navy's lease cost analyses, because lease agreements typically include termination and tax indemnification clauses. The TAKX termination provisions, for example, require the Navy to pay termination costs which would exceed the purchase price at least through the second five-year option. Uncertainties with respect to the IRS characterization of the TAKX contract also increase the potential for higher future lease costs. The Navy, therefore, should be reasonably certain that premature termination would be unlikely, and should attempt (as it has in the past) to obtain firm rulings from IRS regarding the contract. The application of leasing arrangements to standard auxiliary ships that would have continuous use in the Navy over their lifetime would reduce the probability of termination.
- (3) In order to minimize the direct cost of leasing (lease payments), the Navy should design the contracts to take advantage of all factors which affect the lease costs. This includes the debt/equity ratios and mortgage rates in addition to tax benefits.

**b. The Government's Viewpoint**

- (1) The lease/purchase issue involves a decision regarding alternative forms of financing. Therefore, the OMB Circular A-94 directive is not considered applicable with respect to the basis of the discount rate to be used in the Government cost analyses. A discount rate based upon yields on Treasury securities is more appropriate.
- (2) Costing Method I properly accounts for all leasing costs including direct costs, Treasury revenue losses and Treasury revenue gains. However, the method is highly sensitive to assumptions regarding the mortgage holders' tax rates. Minor differences in these assumptions could lead to completely opposite conclusions as to whether to lease or purchase.
- (3) Costing Method II has the advantage of being insensitive to mortgage holders' tax rate assumptions.
- (4) Both methods demonstrate that there are, indeed, financial market and/or contractual conditions when the discounted total Government cost of leasing may be

lower than the Government cost of purchasing and financing the ship or when the cost differences are small enough to neutralize relative costs as a factor in the decision.

## 2. Funding

- a. The issue of whether to lease or purchase ships incorporates a decision as to whether O&M or SCN funds are to be used.
  - (1) Leasing currently requires a long-term commitment of O&M funds and the unobligated balances of the Navy Industrial Fund (NIF).
  - (2) There may be Congressional concern over increasing the fixed-cost proportion of O&M funds and the use of the NIF for substantial lease obligations.
  - (3) Contingent costs, if incurred, could cause a substantial disruption of procurement programs in the future.
- b. Although Congress was kept informed during the TAKX procurement, Congressional review of leasing programs proposed by the Navy is not normally performed concurrent with the review of direct purchase (SCN) programs. Therefore, leasing and purchasing are not considered directly as Government financing alternatives.
- c. The Navy has viewed leasing as a way to conserve SCN funds for procurement of combat ships. Because it has the legal authority to commit unobligated NIF balances, the Navy can enter into lease procurement activities before obtaining Congressional approval. If leasing is applied extensively to ships, this could be a matter of considerable concern.
- d. Because O&M appropriations are made on an annual basis, they are subject to the normal exigencies of the Government budget-making and approval process and possibly severe cut-backs. Long-term leasing programs add to the fixed cost portion of O&M funds; therefore, the discretionary portion of the funds may be reduced. A sharp reduction in O&M appropriations could force a significant re-programming of O&M funds and affect the Navy's overall operating position.

### 3. IRS Regulation

- a. Under current IRS regulations, the lease cost to the Navy is substantially higher if it operates the leased ship under a bareboat charter. This constrains the use of Navy personnel for the day-to-day operation and maintenance of the ship.
- b. Uncertainty about future tax provisions and how the IRS will rule on a leasing contract with the Navy adds to the contingent costs through the tax indemnification provisions of the contract. This, in turn, adds to the uncertainty of how future O&M funds may be committed.
- c. Limitation of lease costs currently imposed by IRS procedures raise the cost to the Navy and the Treasury of leverage leasing.

### RECOMMENDATIONS

#### 1. Leasing as a Viable Alternative

The build-and-lease option may be regarded as a feasible financing alternative to the direct purchase and financing of naval auxiliary ships.

From a relative cost standpoint and regardless of the costing method used, the discounted total cost of build-and-lease programs for acquiring naval auxiliary ships could be lower or slightly higher than the cost of direct purchase programs. In addition, there could be occasions--such as an immediate, unforeseen military requirement--when the Navy or Congress would prefer to accelerate ship acquisition without immediate changes in the SCN budget or general Government finances. Leasing makes this possible, but at the price of increasing the long-term, fixed portion of the Navy's O&M obligations.

## **2. Budget Review**

Build-and-lease programs should be reviewed at the same time and at the same level as purchase programs and in advance of any leasing procurement activity.

For some types of ships, the build-and-lease option may be a sensible financial alternative to purchasing. This implies that the Navy's Ship Construction (SCN) program proposals should be examined each year for possible leasing alternatives.

In any case, all cognizant Government agencies and branches should have the opportunity to perform an unrestricted review of build-and-lease programs at the same time that the purchase programs are reviewed. Leasing impacts on future O&M funds; hence, the agencies would be remiss if they did not perform a thorough review with the options of modifying or, if necessary, vetoing the program.

It should be noted that the Navy has used the build-and-lease option only a few times; hence, there have been limited opportunities for Government-wide consideration. Clearly, if leasing programs become commonplace and/or substantial in terms of total cost, the review of leasing programs needs to be made systematic and thorough.

## **3. Regulations**

If the Navy/Government intends to increase the number of build-and-lease programs, consideration should be given to the modification of IRS regulations and/or practices in order to clarify the nature of the leases.

Clearly, the Navy should not tailor its operations simply to obtain tax benefit "pass throughs" from lessors. Currently, however, in order to assure that the equity owners will receive the maximum tax benefits, so they can pass



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## Chapter I

### INTRODUCTION

#### A. BACKGROUND

In the present atmosphere of budget restrictions, the current planned and approved buildup of naval surface and submarine forces could require new ship construction financial resources substantially above anticipated budget authorizations. This presents the Navy with a major problem as to how to achieve a balanced ship acquisition schedule. High priority combat ships must be procured, but auxiliary ships must also be acquired to support the battle groups.

Table 1-1 presents the Navy's 1983 five-year SCN plan in terms of number of ships.<sup>1</sup> The budget authorization requirements appear in Table 1-2. From the Navy's viewpoint, this plan is already pared down to the minimum number of new ships required to replace out-moded and worn-out ships in the current fleet and to build the fleet into the effective fighting force needed under current and expected international conditions. A major reduction in the SCN budget would impact primarily on the auxiliary ships, because Service priorities tend to give primary emphasis to an adequate combat ship replacement schedule. Therefore, available funds would be applied first to combat ship acquisition. If funds are not

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<sup>1</sup>The 1983 plan is presented here to avoid having to classify this report. The general problem would still exist under the 1984 five-year plan. Not shown are 13 cargo ships (TAKXs) currently being procured under leasing arrangements.

Table 1-1. NUMBER OF SHIPS IN THE NAVY'S FIVE YEAR SCN PLAN,  
BY SHIP TYPE, FISCAL YEARS 1983-1987

SHIP TYPE	ACRONYM	1983	1984	1985	1986	1987	TOTAL
<u>SUBMARINES (NUCLEAR)</u>							
BALLISTIC MISSILE (TITANIC)	SSBN	2	1	1	1	1	6
ATTACK	SSN	2	2	4	4	4	17
TOTAL		4	4	5	5	5	23
<u>SURFACE COMBATANTS</u>							
<u>CARRIER-NUCLEAR</u>	CVN	2	-	-	-	-	2
CARRIER-SLEP*	CV	1	-	1	-	1	3
CRUISER-GUNDED MISSILE	CG	3	3	3	4	4	17
CRUISER-GUNDED MISSILE,	CSN	-	-	-	-	1	1
NUCLEAR							
BATTLESHIP (CONVERSION)	BB	1	1	1	-	-	3
DESTROYER-GUNDED MISSILE	DDG	-	-	1	-	3	4
DESTROYER	DD	-	-	-	2	1	3
FRIGATE-GUNDED MISSILE	FFG	2	2	2	3	3	12
TOTAL		6	6	6	9	13	45
<u>AUXILIARY AND SUPPORT</u>							
<u>MINI COUNTERMEASURE</u>	SCM	4	4	5	-	-	13
MINI HUNTER	MSH	-	1	-	5	5	11
AMPHIBITION	AE	-	-	1	2	1	4
ONLER	TAD	1	3	4	4	6	16
FAST COMBAT SUPPORT	AOE	-	-	1	1	2	4
DESTROYER TENDER	AD	-	-	-	1	1	2
SALVAGE	ARS	1	1	-	-	-	2
CARGO*	TAK	-	-	1	-	-	1
VEHICLE CARGO*	TAKIX	4	-	-	-	-	4
OCEAN SURVEILLANCE	AOOS	-	1	-	2	3	6
SURVEYING*	TAGS	-	-	2	-	-	2
CABLE REPAIR	TARC	-	-	-	1	-	1
MISSILE RANGE, INSTRUMENT	TARIN	-	-	-	1	-	1
HOSPITAL*	TAN	1	1	-	-	-	2
TOTAL		11	11	14	10	17	71
<u>AMPHIBIOUS WARFARE</u>							
ASSAULT SHIP-DOCK	LHD	-	1	-	-	1	2
DOCK LANDING SHIP	LSD	1	2	2	2	3	8
TOTAL		1	3	2	2	4	10
<b>TOTAL, ALL PROGRAMS</b>		<b>25</b>	<b>23</b>	<b>20</b>	<b>33</b>	<b>39</b>	<b>149</b>

\*CONVERSIONS. SLEP - Service Life Extension Program.

SOURCE: Statement of Vice Admiral Robert L. Walters before the House Armed Services Committee, Subcommittees on Strategy and Critical Materials Subcommittees, March 4, 1982.

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Table 1-2. NAVY FIVE YEAR SCN PLAN BUDGET REQUIREMENTS, FISCAL YEARS 1983-1987 (Millions of 1983 Dollars)

SHIP TYPE	ACRONYM	1983	1984	1985	1986	1987	TOTAL
SUBMARINES (NUCLEAR)							
BALLISTIC MISSILE (TRIDENT)	SSBN	2,408	1,704	1,966	1,951	2,944	18,140
ATTACK	SSN	1,443	2,014	2,879	3,101	3,290	12,781
TOTAL		3,851	3,718	4,845	5,052	6,234	22,921
SURFACE COMBATANTS							
CARRIER-NUCLEAR	CVN	8,786	-	-	-	585	7,350
CARRIER-SLEP*	CV	700	100	782	113	722	2,453
CRUISER-GUNDED MISSILE	CG	3,134	3,341	3,524	4,913	5,175	20,087
CRUISER-GUNDED MISSILE, NUCLEAR	CGN	-	-	-	903	2,574	3,477
BATTLESHIP (CONVERSION)	BB	417	400	355	-	-	1,252
DESTROYER-GUNDED MISSILE	DDG	-	100	1,378	452	4,003	6,001
DESTROYER	DD	-	-	-	1,757	902	2,530
FREGATE-GUNDED MISSILE	FFG	606	778	813	1,278	1,340	4,878
TOTAL		11,712	4,878	8,822	8,383	15,248	48,837
AUXILIARY AND SUPPORT							
MINI COUNTERMEASURE	MCN	372	342	440	-	-	1,153
MINI HUNTER	MSN	-	73	-	269	274	616
AMPHIBUTION	AE	-	-	400	825	432	1,756
OILER	TAO	326	536	1,002	1,003	1,700	4,723
FAST COMBAT SUPPORT	AOE	-	-	700	610	1,272	2,580
DESTROYER TENDER	AD	-	-	-	406	485	901
SALVAGE	ARS	64	60	-	-	-	153
CARGO*	TAK	-	3	70	-	-	81
VEHICLE CARGO*	TAKA	323	-	-	-	-	323
OCEAN SURVEILLANCE	AGOS	24	104	-	309	558	1,123
SURVEYING*	TAGS	-	33	100	-	-	213
CABLE REPAIR	TARC	-	-	-	332	-	332
MISSILE BARGE, INSTRUMENT	TABM	-	-	44	80	-	124
HOSPITAL*	TAN	300	200	-	-	-	500
TOTAL		1,423	1,404	3,138	4,874	4,727	14,548
AMPHIBIOUS WARFARE							
ASSAULT SHIP-DUCK	LHX	56	1,326	-	123	900	2,404
DOCK LANDING SHIP	LSD	417	477	851	840	647	3,242
TOTAL		472	1,803	851	963	1,547	5,785
TOTAL, ALL PROGRAMS		17,536	11,987	15,742	19,482	26,808	91,542

\*CONVERSIONS. SLEP - Service Life Extension Program.

SOURCE: Statement of Vice Admiral Robert L. Walters before the House Armed Services Committee, Seapower and Strategic and Critical Materials Subcommittee, March 4, 1982.

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available for auxiliary ships, the active service lives of the existing auxiliary ships would then have to be extended. Under such conditions, fleet effectiveness would be reduced to the extent that the capabilities of the combat ships would be affected by the performance of the older auxiliaries.

#### **B. PURPOSE OF THIS STUDY<sup>1</sup>**

The expectation that the SCN budget will continue to be restrictive along with evident need to increase the size and effectiveness of the naval surface and submarine forces raises the issue as to whether methods of financing other than direct purchase would be feasible. The purpose of this study is to examine the leasing of auxiliary ships as one of these alternatives. It is assumed that the ships would be built (or converted) to Navy specifications by private sector shipbuilders, purchased by private sector leasing organizations, and then leased to the Navy.

#### **C. PRECEDENTS FOR LEASING NAVAL SHIPS**

The Navy has used the build-and-lease (charter) procedure in the past and has recently (August 1982) entered into a new leasing program to acquire cargo ships which would be used as a prepositioned supply force for Marine Amphibious Brigades.<sup>2</sup> To provide additional background for the analyses in subsequent chapters, it will be helpful to review two of these programs.

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<sup>1</sup>Appendix A contains the text of the Task Order for the study.

<sup>2</sup>Although there are technical differences, the terms "lease," "charter" and "time-charter" are used synonymously unless otherwise noted.

1. The 13-TAKX Program

The Navy has recently (August 17, 1982) awarded contracts to build- or convert-and-charter six TAKX cargo ships with options to award seven additional ships in fiscal year 1983. The 13 ships are to be acquired under the Maritime Prepositioning Ships (MPS) program designed to provide prepositioned supplies for three Marine Amphibious Brigades. An analysis of the cost estimates of the three winning contractors is presented in Table 1-3.<sup>1</sup>

As will be explained in more detail in Chapter II, the procurement procedure is rather complex. The three contractors are responsible for acquiring the ships. General Dynamics will build five ships in its Quincy, Massachusetts shipyard. The other two firms will contract with private shipbuilders to convert ships they now own to Navy specifications. When the ships are completed, they will (may) be sold to a private organization (equity group) which will provide about 40 to 45 percent of the ship acquisition cost.<sup>2</sup> The remaining funds will be obtained through the issuance of long-term mortgage bonds. The equity group organization--which will be the legal owner of the ship--then will lease the ships under a "bareboat" lease to the operating organizations (General Dynamics, Maersk, and Waterman) which then will enter into a "time-charter" arrangement with the Navy. Under this arrangement, the Navy

1. Charters the ship for a specified period of time. In this case the period is five years with options to charter for four additional five year periods.

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<sup>1</sup>From this point on the study which generated the figures in Table 1-3 will be called "The Navy Study."

<sup>2</sup>The contractors may make internal arrangements for the equity funds.

Table 1-3. COST ESTIMATES OF TAKX PROGRAM

Contractor (Lessors)	Number of Ships Awarded	Average Purchase Cost <sup>1</sup> (\$Millions)	Annual Lease Payment <sup>2</sup> (\$Millions)		
			Period	Amount (\$Millions)	25-year Average
General Dynamics	5(2 firm)	178.69	1986-1997	14.23	15.81
			1998	15.81	
			1999-2010	17.39	
Maersk Line, Ltd.	5(3 firm)	196.79	1985	8.09	17.98
			1986-1997	16.19	
			1998-2009	19.78	
			2010	9.89	
Waterman Steamship Corp.	3(1 firm)	171.57	1985	7.18	15.96
			1986-1997	14.37	
			1998-2009	17.56	
			2010	8.78	

Source: Argent Group Ltd., TAKX Maritime Prepositioning Ships, Supplemental Report (August 19, 1982).

<sup>1</sup>Capitalized cost. Includes construction cost plus cost of financing construction and other costs associated with the financing of the ship under the time-charter arrangement.

<sup>2</sup>Assumes that Investment Tax Credit will be allowed to lessors. These are actually estimates provided by the above source based on information supplied by the offerors.



2. Contracts for the operation of the ship by the ship operator. The latter provides all of the operating and maintenance services and pays all expenses.<sup>1</sup> It bills the Navy for these services and expenses on a quoted daily rate basis.

The lease payments in Table 1-3 represent only the time charter cost to the Navy. They do not include the operating costs which will vary depending upon the operating status of the ships. For comparative purposes it is assumed throughout this report that the operating costs will be roughly equivalent whether the ship is operated entirely by Navy or civilian crews.

## 2. Build and Charter Program for Nine Tanker Ships<sup>2</sup>

The second precedent for leasing naval ships is the procurement of nine new tankers in June 1972. As with the TAKX procurement, three contractor/lessors were selected:

- Marine Transport Lines, Inc. (composed of two leasing companies),
- Citicorp Leasing, Inc., and
- Salomon Brothers.

Notice that the contractors were leasing or financial organizations. These firms arranged for the construction of the ships by two shipyard companies, Bath Iron Works and Todd Shipyards. They then arranged the equity and long-term debt financing of the ships by finding equity participants and

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<sup>1</sup>Certain military equipment and cargo are handled by Navy and/or Marine crews assigned to the ships, but these personnel do not engage in ship operations.

<sup>2</sup>See Reference [5] for a more detailed description of this program.

purchasers of long-term bonds.<sup>1</sup> The bonds were secured by assignment of the Navy's lease payments to a trustee for the debt holders. The Navy chartered the ships for a five year period with options to renew for three additional five-year periods. The effective lease period, therefore, was 20 years, and the bonds were based upon this period.

The TAKX and Nine-Tanker programs illustrate the "leveraged lease" concept which is discussed further in Chapter II. Under this procedure, the equity participants supply only a fraction of the capitalized cost of the ships; yet they are regarded as the owners of the ship and are entitled to all tax shelters and credits associated with the entire acquisition cost. The "leverage" occurs as a result of being able to utilize these tax benefits, especially during the early years of the lease period. For example, they can be applied to reduce tax liabilities on other income so that the firms' overall tax obligations would be reduced.

#### D. ISSUES EXAMINED

There are precedents for building and then leasing naval ships and there are budgetary pressures which encourage the Navy to search for financing alternatives other than direct purchase. This leads to several questions:

1. What are the relative costs of leasing versus purchasing a ship?
2. What are the funding implications of entering a major leasing program?
3. Are there other issues relating to the lease/purchase decision that should be considered?

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<sup>1</sup>See Appendix C for lists of the equity and bond-holding organizations.

## **E. REPORT ORGANIZATION**

The report is organized to address these issues directly. It is necessary at the outset to discuss the "leveraged leasing" concept in more detail, because this is the procedure for leasing high cost capital equipment such as naval ships. The discussion appears in Chapter II, along with a brief description of the computer program (IDALEASE) which was developed to calculate the various costs. (A more detailed description of this program is provided in Appendix B.)

Chapter III examines the relative costs of leasing versus purchasing from the Navy's point of view. Here it is recognized that the Navy is concerned primarily with the direct costs--exclusive of Treasury Department financing and tax revenue effects--of leasing or purchasing and the impacts of these direct costs on the Navy's Ship Construction and Conversion (SCN) or Operation and Maintenance (O&M) budgets. Part of the funding issue, therefore, is also examined in this chapter.

Chapter IV examines the lease/purchase cost issue from the Government's point of view. Government costs include not only the direct costs of leasing or purchasing but also the net effects on the Treasury of tax losses or gains from the leveraged-lease transactions. The methods of accounting for the effects on the Treasury and the proper discount rates to use when comparing purchase and lease costs have been the main sources of the controversy mentioned in the Preface of this paper.

Chapter V raises other related issues which could not be addressed thoroughly in this study but which should be considered in the lease/purchase decision. For example:

1. What are the funding implications of major leasing programs? How would funding be handled by the Navy and the Government?
2. Are there contingent costs which must be considered?
3. If the Navy decides to use leasing as a regular procurement procedure, are there certain regulatory actions that would facilitate future procurements of this nature?
4. What are the economic impacts of shipbuilding programs and how would these impacts be affected by purchase versus lease decisions.

Finally, conclusions and recommendations are presented in Chapter VI.

As indicated earlier, the "leveraged leasing" concept is fundamental to the purchase versus lease analysis. The next chapter explains the key aspects of this arrangement.

## Chapter II

### ANALYTICAL APPROACH

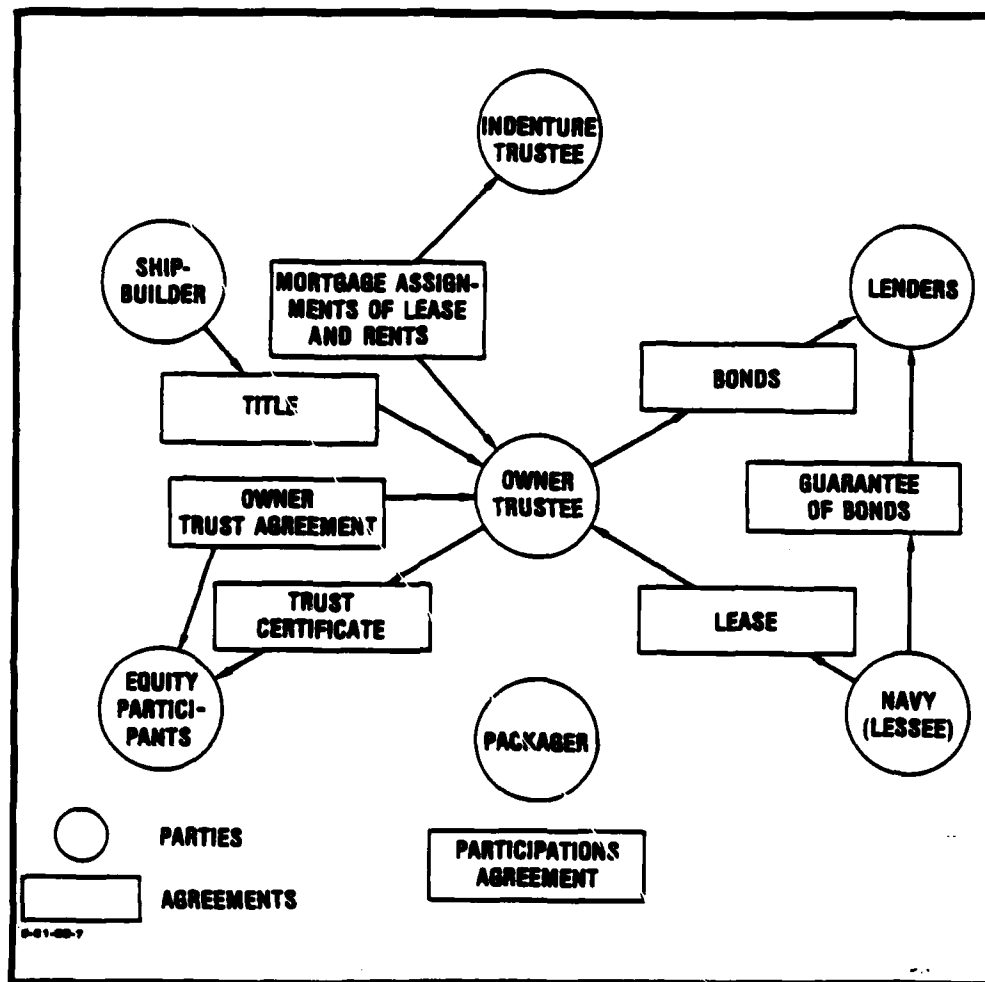
The TAKX and nine-tanker procurement efforts provide a leasing model which can be used in the purchase versus lease analysis. The model is called a "leveraged lease" and it is often used in the private sector as an alternative long-term financing procedure when very large capital acquisitions are necessary and the user of the capital equipment cannot take advantage of the tax benefits associated with direct purchase of the equipment.<sup>1</sup> The computer program used to perform the purchase versus lease cost analysis presented in subsequent chapters is based upon this leveraged lease model. This chapter describes the leveraged lease concept, examines certain tax issues involved in lease provisions, and briefly introduces the general features of the computer program.

#### A. THE LEVERAGED LEASE CONCEPT

The parties, agreements and cash flows for a typical leveraged lease are shown in Figures 2-1 and 2-2. Although all parties and agreements may not be involved in the

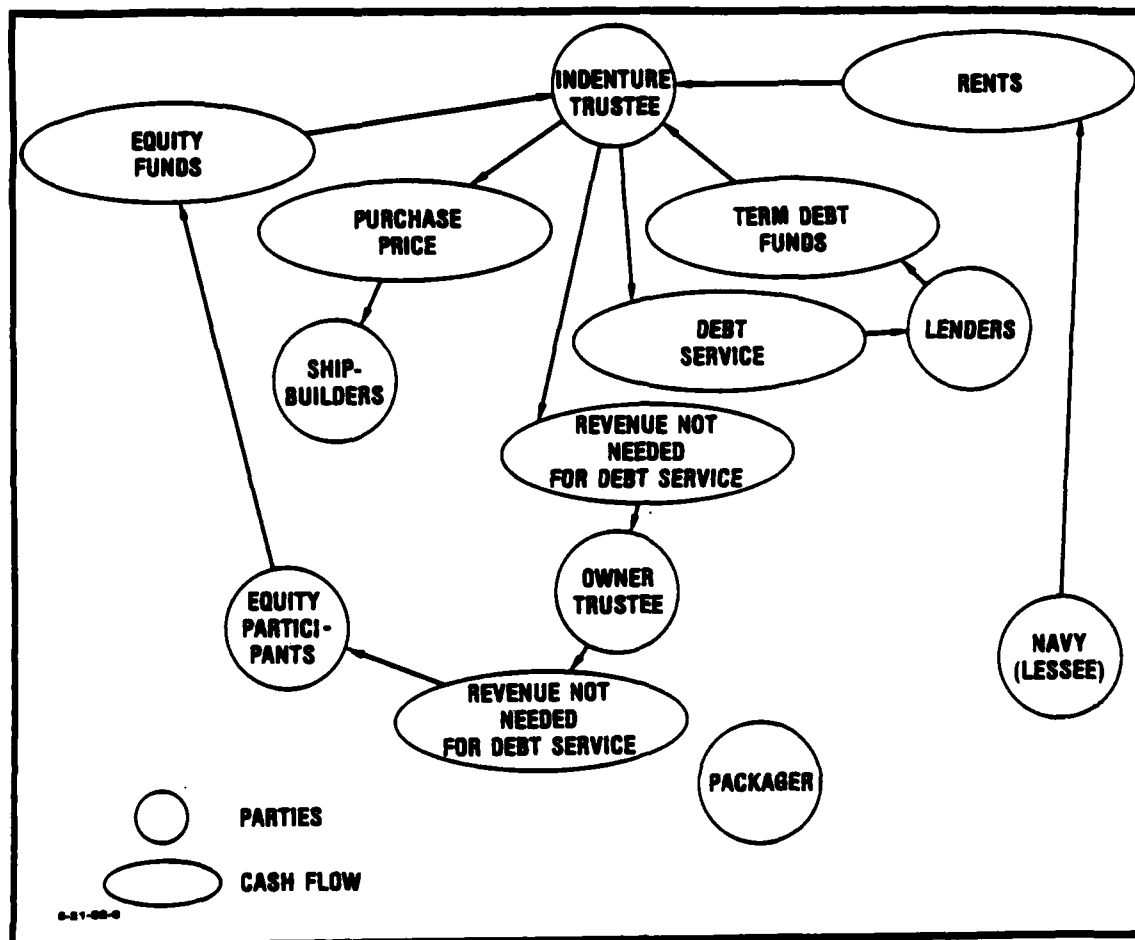
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<sup>1</sup>See Reference [1] for applications of leveraged leasing to public utilities. Reference [2] provides a similar application to leasing commercial ships. References [3] and [4] use the leveraged leasing model in the analysis of the TAKX program; and the model is implied in the nine-tanker procurement in Reference [5]. In other words, leveraged leasing is common practice in both private and public sectors, especially under current tax laws.



Source: Based on Reference [1], p. 13.

Figure 2-1. LEVERAGED LEASE PARTIES AND AGREEMENTS



Source: Based on Reference [1], p. 13.

Figure 2-2. LEVERAGED LEASE PARTIES AND CASH FLOW

transaction, the primary parties are always present. These are:

1. The lessors (equity participants-owners) who acquire the ships from the shipbuilder and lease them to the operators.
2. The lenders (long-term debt holders).
3. The lessee (charterer).

1. Lessors (Equity Participants)

The modifier "leverage" is used to describe the procedure whereby the equity participants supply only a fraction, usually 20 to 50 percent, of the acquisition cost and obtain a long-term loan for the remainder. The "leverage" comes from the fact that, as owners of the ship, the equity participants obtain all of the tax benefits even though the equity in the ship is small relative to the total cost of the ship.

The owners may deduct from lease income:

- Interest on bonds secured by the ship,
- Depreciation,
- Other associated expenses.

The depreciation provisions are of particular importance. Under current tax laws a ship qualifies as five-year property under the Accelerated Cost Recovery System (ACRS) classification scheme. This rapid rate of depreciation of the capital cost of the ship, combined with interest expenses on the long-term debt incurred in the early years of the lease, provide a series of large tax deferrals or shelters in the early years of the lease. Sheltered income not paid out in taxes is available for reinvestment. Accounting losses from the lease can be applied to net profits from other projects or carried forward to reduce taxable profits in subsequent years.



An additional Investment Tax Credit (ITC) may or may not be available depending upon the nature of the lease. This issue is discussed in Section B.

## **2. Lenders (Long-Term Debt Holders)**

The long-term loan is a non-recourse loan secured by the leased asset and by first claim on the lease payments of the lessee.<sup>1</sup> The term of the loan is usually equal to the full term of the lease, including renewals. For very large loans, such as would be the case with naval ships, mortgage bonds may be sold to a variety of institutions, both profit and non-profit, as well as to individuals. The funding process is the same as or similar to any issuance of bonds in the financial markets. The long-term bondholders receive interest and return of principal according to the provisions of the bond indenture. They, of course, must pay federal income taxes on the interest portion of the payment; the tax rate will vary according to the tax position of each organization or individual holding the bonds.

## **3. The Lessee (Charterer)**

The Navy may be a direct lessee, as under a bareboat lease, or may elect to enter into a time-charter arrangement with the owner/operators. Under a bareboat lease, the Navy has full control of the ship and has the full range of options

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<sup>1</sup>Because the loan is a non-recourse loan, the equity participants are not liable for losses arising out of a default on that loan. Also, this means that the debt is rated at the credit rating of the lessee, not of the equity participant. This places a restriction on the size of the lease payment. Under the standard protocol for a minimum leveraged lease, the lease payment must be large enough to service the debt. Modifications of the standard procedure for leasing to government agencies could permit a lower lease payment.

as to how it will be manned and operated. Under a time-charter arrangement, the owner/operator has control of the ship and it is usually manned and operated by civilian personnel. In either case the Navy makes specific lease or charter payments for the use of the ship or space on the ship, respectively. Operating payments are handled on a separate basis.

#### 4. Other Parties

Whether or not the transaction involves the various trustees and other parties in Figures 2-1 and 2-2 is not significant to the general analytical results; however, the existence of such parties could involve certain costs (legal fees, debt service fees, etc.) which must be considered.

#### B. TAX ISSUES

Clearly, the tax benefits received by the lessors have an important bearing on the lease costs. The lease provisions, therefore, must be carefully stated to assure that the Internal Revenue Service allows all of the appropriate benefits. Unfortunately, it is not always clear how the IRS will rule on a particular lease.

##### 1. True Lease<sup>1</sup>

If the lease were considered a "true lease," the lessor would be eligible for depreciation deductions under the five-year Accelerated Cost Recovery System (ACRS). However, the lessor would not be allowed to take the ten percent Investment

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<sup>1</sup>A history of the IRS procedures relating to true leases appears in Reference [1], pp. 9-10. Also, see Reference [5], pp. III-6 and III-7.

Tax Credit, because property leased to the Federal Government does not qualify for this credit.

Under Revenue Procedure 75-21, the IRS issued the following guidelines in determining whether a transaction is a true lease:<sup>1</sup>

- a. The lessor must maintain a 20 percent minimum "at risk" equity investment throughout the lease term;
- b. The residual value of the equipment at the end of the lease term must be at least equal to 20 percent of the original cost of equipment without taking into account inflation or deflation; and the remaining useful life at the end of the lease term must be at least one year or 20 percent of the originally estimated useful life, whichever is longer;
- c. The lease term for purposes of the foregoing tests includes all renewal periods except renewals at the option of the lessee at fair market value rental;
- d. The lessee or a related party may not have any contractual right to purchase the property from the lessor at a price less than fair market value and the lessor must not have any contractual right to require any party to purchase the property;
- e. The lessee or any related party may not provide any part of the cost of the property;
- f. The lessee or any related party may not lend to the lessor any of the funds necessary to acquire the property or guarantee any indebtedness incurred in connection with the acquisition of the property;

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<sup>1</sup>Reference [1], pp. 9-10.

- g. The lessor must represent and demonstrate that it expects to receive a profit from the transaction apart from any tax benefits but including the residual value of the equipment;<sup>1</sup>
- h. While uneven rent will not affect the status of the lease as a true lease, if the rent for any year is more than ten percent above or below average level rent (there is also an alternate test), a ruling must also be requested as to whether any of the uneven rent is prepaid or deferred rent. (If prepaid, the rent is not deductible currently by the lessee and, if deferred, the rent is currently includable in income by the lessor.)

Under a true lease arrangement, the Navy could lease the ship directly from the owners (equity participants) under a bareboat charter. The Navy then could operate and maintain the ships using Navy personnel. But, as will be shown later, the lease cost to the Navy would be higher than under a time-charter arrangement.

## **2. Receipt of Services Through a Time-Charter**

Under current IRS regulations, the equity participants would be eligible for the ITC and the full amount of the ACRS deductions if the ship were leased to a private organization such as a ship operator. In the TAKX procurement, Maersk Line, Ltd. and Waterman Steamship Corporation are ship operators. Equity groups will be created to purchase the ships and lease them to the operating firms. General Dynamics will probably create both an equity group and an operating organization as separate entities within the conglomerate.

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<sup>1</sup>This section requires that the lease payments must be large enough to cover debt service and any other cash expenses incurred by the lessor in connection with the lease. An exemption from 75-21 might be necessary to permit a full pass through of tax benefits to the Navy at certain interest rates.

The Navy enters the scene as a charterer of space on the ship over a period of time--the time-charter concept.<sup>1</sup> Under this concept the Navy does not have operating control of the ships, although it designates their location and schedule. The operator must have control over navigation, management, maintenance, supplies and the crew and must pay normal operating expenses associated with ship operation such as maritime insurance. The Navy is billed for these operating expenses on a daily rate bases. The IRS has previously considered time-charters to be service contracts.<sup>2</sup>

### 3. Significance of the Tax Benefits

In either of the above arrangements, the owner passes through the tax benefits to the lessee, and ultimately to the Navy, by way of lower lease payments. This is accomplished by fixing the rate of return on the owner's equity contribution and discounting the owner's net cash flow stream generated under the alternative tax benefit conditions. The Navy's lease cost, therefore, would be affected by the characterization of the transaction by the IRS and by the interest rate on the senior debt.

A direct bareboat lease by the Navy yields smaller tax benefits to be passed through than would be the case under a time-charter arrangement, because the IRS does not allow the ITC to lessors when the property is leased directly to the Government; therefore the lease payments by the Navy would be larger under a bareboat lease. To obtain the lower lease cost

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<sup>1</sup>The time-charter concept is commonly used in the shipping industry.

<sup>2</sup>See Reference [14], Appendix B for a full discussion of the "service contract" question.

that inclusion of the ITC would provide, the Navy must enter an arrangement which the IRS would characterize as a "service contract." To the extent that this does not encumber military operations, and civilian operating and maintenance costs are equivalent or lower than they would be under Navy personnel, the Navy gains from the arrangement. However, some auxiliary ships are not conducive to civilian operation so that the direct bareboat lease procedure would be the only option available.

An important point that should not be overlooked is that the cost to the Navy is not the same as the final cost to the Government. The Government's cost must take into consideration the fact that the tax credits taken by the owners represent lost revenue to the Treasury. These may or may not be recaptured from income taxes paid by the owners, mortgage holders or others involved in the lease transaction.

### **C. THE IDALEASE COMPUTER PROGRAM**

A more detailed description of the IDALEASE computer program is provided in Appendix B. Its main features are summarized below.

#### **1. Program Inputs**

Table 2-1 presents the primary inputs to the program; notice that they are modeled on the leveraged-lease concept. The program is designed to facilitate sensitivity analyses such as will be presented in Chapters III and IV. Inputs are entered interactively at a terminal as changes to internally stored, base-case (default) values. This minimizes the number of input entries needed when performing the sensitivity analyses.

Table 2-1. IDALEASE PROGRAM INPUTS

1. CAPITAL PROVISIONS
  - a. Acquisition cost
  - b. Residual value of asset
2. LEASE PROVISIONS
  - a. Number of years in lease
  - b. Frequency of lease payments
3. EQUITY/DEBT PROVISIONS
  - a. Debt percent
  - b. Equity percent (100-debt percent)
4. DEBT SERVICE PROVISIONS
  - a. Interest on mortgage debt
  - b. Debt service fee
  - c. Frequency of debt payments
5. OTHER EXPENSE PROVISIONS
  - a. Closing cost percent
  - b. Percent of closing costs borrowed
  - c. Interest rate on borrowed closing costs
  - d. Other expenses (by period)
6. EQUITY HOLDER PROVISIONS
  - a. After-tax rate of return
  - b. Sinking fund rate of return
7. TAX PROVISIONS\*
  - a. Accounting cycle (payment of estimated taxes)
  - b. ACRS class (e.g. 5-year)
  - c. Capital cost allowable for ACRS (percent)
  - d. Investment Tax Credit (ITC)
  - e. Income tax rates
    - (1) Owners (equity holders, lessors)
    - (2) Mortgage holders (lenders)
8. DISCOUNT RATE FOR COMPUTING GOVERNMENT COSTS

\*Program uses tax provisions required under the 1983 tax laws as they apply to the ACRS factors and the adjustment of the capital basis by 1/2 of the ITC.

A more detailed discussion of the key input values is presented in Chapter III.

## 2. Program Outputs

Summary outputs are the following:

- a. The minimum lease payment that would be offered by a lessor under the specified input conditions. This is obtained by an iterative process described in Appendix B, Section II-I.
- b. Navy and Government undiscounted and discounted total lease costs using costing Methods I and II. (These two methods are described in Chapters III and IV, respectively).

In addition to the summary outputs, every pertinent cost stream can be displayed optionally. This provides the capability to explore in detail the underlying causes of changes in the summary values. A sample of each detail table is given in Appendix B.

Thus the IDALEASE program is designed to explore the consequences of alternative leveraged leasing conditions and provisions;<sup>1</sup> in this respect it is independent of the type of lease (bareboat lease, time charter, etc.). In addition, it can be applied to any type of capital asset. But its immediate purpose is to assist in making the purchase versus lease decisions with respect to naval auxiliary ships, and it is to this task which we now direct our attention.

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<sup>1</sup>IDALEASE does not constrain the lease payment to cover the debt service on the senior debt.



### Chapter III

#### LEASE VERSUS PURCHASE COSTS: THE NAVY'S POINT OF VIEW

This chapter focuses on the lease (build-and-charter) versus purchase costs that must be accounted for by the Navy in its appropriations accounts. Therefore, the analysis excludes finance costs or tax losses that may be incurred by the Treasury Department. The latter costs are analyzed in Chapter IV. The procedure here will be first to indicate how the Navy must account for direct purchase and lease costs;<sup>1</sup> the cost analysis then will be performed in the context of these accounting requirements.

##### A. ACCOUNTING FOR DIRECT PURCHASE AND LEASE COSTS

The Navy has two sources of funds for obtaining the use of a ship:

- (1) Ship Construction and Conversion (SCN) appropriations for direct purchase of new or converted ships; and
- (2) Operation and Maintenance (O&M) appropriations for leasing (chartering) new or converted ships. This is handled through the Military Sealift Command (MSC), which is an activity supported by the Navy Industrial Fund (NIF).

From the Navy's viewpoint, the costs to be considered are the direct charges against the accounts associated with one or the other of these two general appropriation sources. These

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<sup>1</sup>Contingency costs associated with leasing are discussed in Chapter V.

direct charges do not include financing costs and/or tax losses incurred by the Treasury Department.

1. Purchase Costs

When the Navy executes a contract for the purchase of a ship, it must immediately record the estimated total amount of the contract as a decrease in "...the unobligated balance apportioned or otherwise available...", with corresponding adjustments of accounts designed to keep track of accrued expenditures and actual disbursements.<sup>1</sup> A large shipbuilding contract will usually contain provisions for progress payments

"...based upon the estimated contract price of the work-in place at month-end, including, where applicable, the cost of material delivered to the site and 'appropriated' for the job."<sup>2</sup>

Actual disbursements will occur throughout the contract period. A certain percentage of the contract may be "held back" by the Navy until the work has been completed, the ship delivered, and all claims have been processed and agreed upon.

Thus, when the Navy purchases a ship it expects to make a stream of budget disbursements<sup>3</sup> throughout the contract period (from contract award through delivery and acceptance of the ship), and, ideally, these disbursement will add to the total obligation set forth at the contract award date. These disbursements are not adjusted for "unfunded costs" such as Treasury Department finance costs, depreciation, or revenue

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<sup>1</sup>Reference [12], p. 221-16.

<sup>2</sup>Ibid., [12], p. 222-9.

<sup>3</sup>Ibid., p. 240-2 for a discussion of budget disbursements.

losses due to taxes.<sup>1</sup> To the Navy, a ship construction cost of \$100 million means a \$100 million reduction in its total SCN unobligated balance as of the award date and a stream of disbursements to pay for the ship over the full contract period. When all payments have been made, the Navy is finished with the transaction and has no further budget disbursements, except, of course, various adjustments to account for errors or special claims against the contract.

## 2. Lease (Charter) Costs

When the Navy leases a ship under a time-charter arrangement, the lease payment is made on a periodic basis beginning sometime after the ship is made available for use.<sup>2</sup> Therefore, the Navy expects to be making a stream of budget disbursements over at least the initial lease period (usually five years) and plans to renew the lease for several successive five year periods. The payments would be made through the Navy Industrial Fund by the Military Sealift Command.

However, because of accounting regulations, there may be severe constraints on the Navy's ability to enter into a build-and-charter agreement. Under a typical agreement of this nature, the Navy must normally

- (1) Sign a five-year lease commitment
- (2) Indemnify the lessors against
  - (a) early termination of the lease

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<sup>1</sup>See Reference [12], p. 250-5 for a discussion of unfunded costs.

<sup>2</sup>Under the TAKX RFP, lease payments are to begin 6 months after delivery of the ship and are to be paid semi-annually throughout the term of the lease. See Reference [6], Attachment I, Article 5(a).

- (b) changes in certain tax benefits upon which lease payments are based.

These provisions are discussed in more detail in Chapter V. At this point we wish to note only that accounting regulations require that any obligations, such as the five-year lease commitment and termination costs, must be recorded in its full amount upon execution of the agreement, and the obligation authority or unobligated funds for this full amount must be available.<sup>1</sup> Therefore, the Navy could be restricted from entering into a build-and-charter contract, and/or renewing a five year lease if unobligated balances or O&M appropriations were not available.

## **B. COST ANALYSIS**

We turn now to the analysis of the direct purchase and lease costs to the Navy; that is, the costs which the Navy must account for out of its appropriations.

### **1. Input Values for Determining Lease Costs**

The key input values for the lease cost analysis are presented in Table 3-1. A discussion of some of the variables is required at this point.

#### **a. Capital Provisions**

We have deliberately chosen the term "acquisition cost" (item 1a in Table 3-1) rather than "capitalized cost" because

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<sup>1</sup>Reference [12], p. 221-3.

Table 3-1. INPUT VALUES USED IN DETERMINING  
LEASE COSTS TO THE NAVY

Input Item	Value
1. CAPITAL PROVISIONS	
a. Acquisition cost	\$100 Million
b. Residual value of asset	0%
2. LEASE PROVISIONS	
a. Term of lease	25-years
b. Frequency of lease payments (in arrears)	Semi-annual
3. EQUITY/DEBT PROVISIONS	
a. Debt percent	Varied
b. Equity percent	(100-3a)
4. DEBT SERVICE PROVISIONS	
a. Interest on mortgage debt	Varied
b. Debt service fee	0%
5. OTHER EXPENSE PROVISIONS	
a. Closing cost percent	2½%
b. Percent of closing costs borrowed	Same as 3a
c. Interest rate on closing costs	Same as 4a
6. EQUITY HOLDERS AFTER TAX RATE OF RETURN	12%
7. TAX PROVISIONS (1983 TAX LAWS)	
a. ACRS (depreciation) class	5-years
b. Capital cost allowable for ACRS (Percent)*	100%
c. Investment tax credit (Percent)	10% or 0%
d. Lessor income tax rate	46%
e. Tax accounting period	quarterly

\*Program reduces allowable by ½ of investment tax credit as required under 1983 tax laws.

of the confusion associated with the latter term.<sup>1</sup> We define "acquisition costs" as consisting of those costs directly associated with the acquisition of the ship by the lessors which may be used as the basis for determining Accelerated Cost Recovery System (ACRS) deductions and the Investment Tax Credit (ITC). These costs do not include expenses associated with obtaining the mortgage or packaging the lease agreement, which we include under "OTHER EXPENSE PROVISIONS." It is our understanding that these expenses may not be included in the bases for determining ACRS deductions and the ITC, but must be amortized over the term of the lease. The IDALEASE program uses the straight line method for amortizing these costs.

A question arises as to whether the acquisition (purchase) cost of the ship would be the same for the Navy as for the lessors. This question is difficult to answer with certainty. Some costs that would be allowed as the capital basis by the Internal Revenue Service in a private purchase might not be allowed by a Contracting Officer in a cost plus fixed fee purchase by the Navy. On the other hand, stringent inspection standards by the Navy and the Navy's tendency to introduce design changes during construction might increase the Navy's final cost. Much depends upon the design characteristics of the ship and the length of the construction period. For the purposes of this analysis, therefore, we have elected to assume that the direct purchase cost to the Navy is

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<sup>1</sup>The definition used in the TAKX agreement includes items that would not be allowed by IRS as the capital basis for accelerated depreciation (ACRS) and the Investment Tax Credit (ITC). See Reference [6], Attachment D, Schedule I-A(1).

equal to the IRS allowable acquisition cost to the lessors/owners.<sup>1</sup>

Because the term of the lease is 25 years, we have assumed that the residual value (item 1b in Table 3-1) of the ship at the end of the period is zero. The influence of the residual value on lease payments is minor for lease terms of 25 years or greater.

**b. Lease Provisions**

As indicated above, the term of the lease is 25 years. Lease payments are made semi-annually in arrears; i.e., the first payment is made six months after the delivery of the ship. This is the procedure used in the TAKX procurement.<sup>2</sup>

**c. Equity/Debt Provisions**

Lease payments are highly sensitive to the percent of the acquisition cost which is mortgaged. The complement of this percent is the equity held by the lessors/owners. The analysis varies the percent mortgaged from 50 to 80 percent.

**d. Debt Service Provisions**

The interest on the mortgage debt is also allowed to vary. The range is five to 15 percent. Although a debt service fee is sometimes charged by the Indenture Trustee, we have assumed that it is zero.

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<sup>1</sup>The terms "lessors", "owners", and "equity owners", are used interchangeably throughout the remainder of this paper.

<sup>2</sup>Reference [6], Attachment I, Article 5(a).

**e. Other Expense Provisions**

Closing costs amounting to 2 1/2 percent of the acquisition cost have been applied in this analysis. As mentioned earlier, these costs include all fees associated with the mortgage financing portion of the lease<sup>1</sup>, packagers fees, and any other expenses related to the lease transaction. A check with private firms engaged in leveraged leasing indicates that we might have overestimated these costs because the percent varies with the size of the deal and could be as little as .5 percent. These sources also indicate that the portion of such costs that would be borrowed and the corresponding interest rate will usually be about the same as for the mortgage debt.<sup>2</sup>

**f. Equity Holders After Tax Rate of Return**

A 12 percent after-tax rate of return for the equity holders is assumed. This is consistent with the 12.43 percent rate used in the Navy Study which was performed during a period of higher interest rates.<sup>3</sup>

**g. Tax Provisions**

(1) ACRS Class -- Currently (1983 tax laws) ships may be placed in the five-year ACRS classification. This means that the following percentages of the acquisition cost may be deducted:

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<sup>1</sup>Finance costs associated with the construction of the ship would be included in the acquisition cost.

<sup>2</sup>An earlier version of our analysis arbitrarily assumed that 50 percent of the closing costs would be borrowed at an interest rate equal to the prime rate.

<sup>3</sup>Reference [3], Appendix A.



<u>Year</u>	<u>Percent</u>
First	15
Second	22
Third	21
Fourth	21
Fifth	<u>21</u>
Total	100

The 1983 tax law indicates that these factors will be used for assets acquired in future years. The 1982 law indicated that the factors would be changed to the following values in 1985 and beyond:

<u>Year</u>	<u>Percent</u>
First	20
Second	32
Third	24
Fourth	16
Fifth	<u>8</u>
Total	100

The latter factors were used in the Navy Study and the earlier version of this study, because it was assumed that the ships would be delivered after 1985.

(2) Capital Cost Allowable -- In this analysis we assume that IRS will characterize the Navy's contract with the operators as a service contract. This means that the equity owners would be allowed to deduct 100 percent of the allowable acquisition cost using the ACRS factors. However, under the 1983 tax law, the allowable acquisition cost must be reduced by one-half of any investment tax credit taken.<sup>1</sup>

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<sup>1</sup>The 1983 tax law provides an alternative to this procedure; however, the alternative would normally not be applied by equity holders in a 46 percent tax bracket.

(3) Investment Tax Credit --The analysis examines the effect of the Investment Tax Credit on lease payments. Either ten percent or zero percent is used.

(4) Lessor Income Tax Rate -- The lessor's federal income tax rate is assumed to be 46 percent. No state taxes are assumed. Mortgage holder income tax rates are not a factor in determining lease payments. However, they are considered in Chapter IV when calculating government costs.

(5) Tax Accounting Period -- In the IDALEASE program, the lessor pays estimated income taxes each quarter. Tax credits and ACRS deductions are included in the estimates along with other expense deductions.<sup>1</sup>

## 2. Analysis of Lease Costs to the Navy

Table 3-2 and Figure 3-1 present estimated annual lease costs of a \$100 million ship for various values of mortgage interest rates and the percent of the acquisition cost mortgaged.<sup>2</sup> Table 3-3 shows the total (undiscounted) lease costs over the entire 25-year period.

### a. Costs Under Current Financial Market Conditions

Consider first the annual lease costs under current (June 1983) financial market conditions. At this time the market

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<sup>1</sup>See Appendix B, Table B-7, for an example of how the IDALEASE program accounts for tax deductions.

<sup>2</sup>The lease payments for any ship acquisition cost can be obtained by multiplying the payments in Table 3-2 by the ratio of the acquisition cost to \$100 million. For example, the payments for a \$184 million ship can be calculated by multiplying the payments in Table 3-2 by 1.84. Similarly, the total cost of leasing the ship can be obtained by multiplying the figures in Table 3-3 by the appropriate ratio (e.g., 1.84).

Table 3-2. ANNUAL LEASE PAYMENT ON A \$100 MILLION SHIP,<sup>1</sup>  
 BY MORTGAGE INTEREST RATE AND PERCENT MORTGAGED  
 25-YEAR LEASE PERIOD  
 (Dollar Figures in Millions)

Mortgage Interest Rate (%)	Percent Mortgaged			
	50	60	70	80
5	7.0	5.6	4.2	2.8
6	7.3	6.0	4.6	3.3
7	7.6	6.4	5.1	3.8
8	7.9	6.8	5.6	4.4
9	8.3	7.2	6.1	4.9
10	8.7	7.6	6.6	5.5
11	9.1	8.1	7.1	6.1
12	9.5	8.6	7.7	6.8
13	9.9	9.1	8.3	7.5
14	10.3	9.6	8.9	8.1
15	10.7	10.1	9.5	8.8

<sup>1</sup>Includes Investment Tax Credit. See Table 3-1 for other input values in lease calculations.

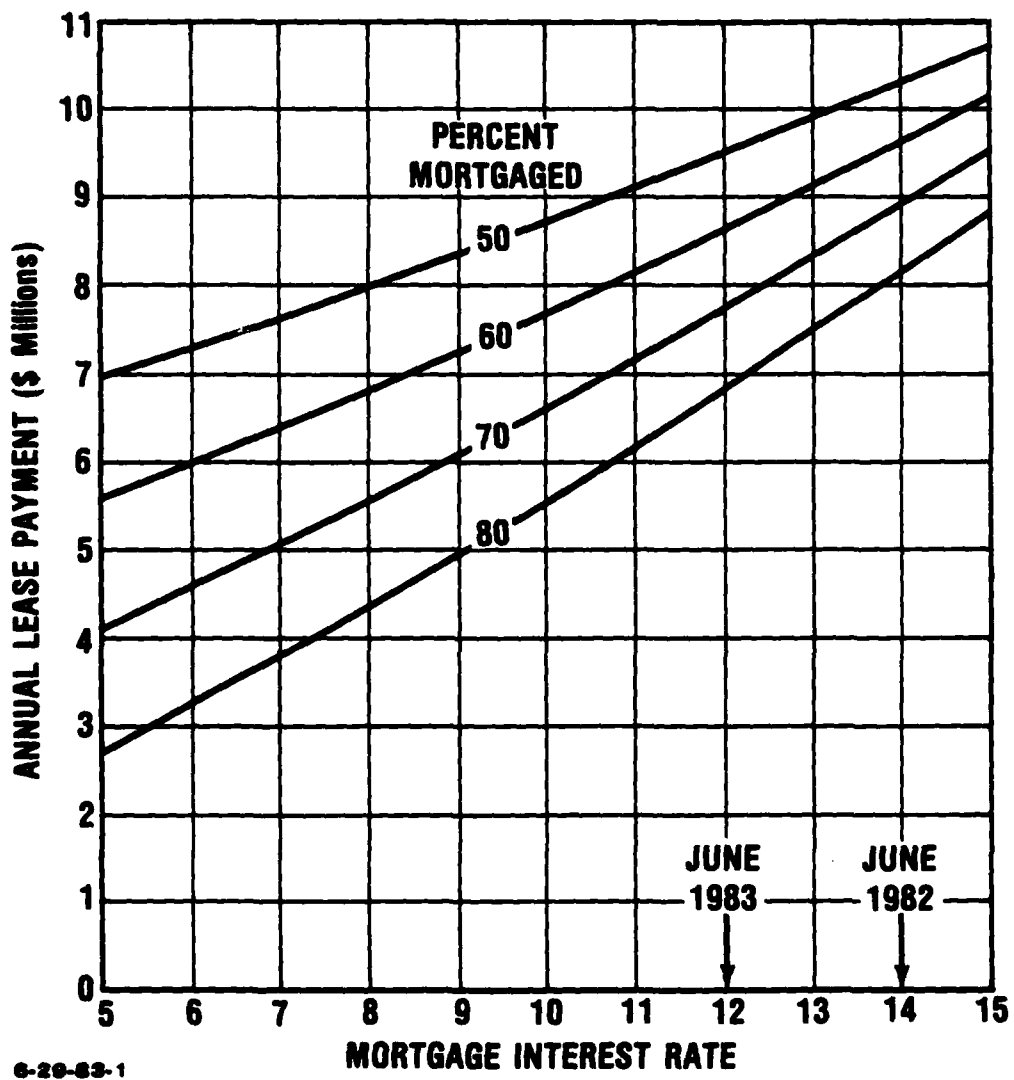


Figure 3-1. ANNUAL LEASE PAYMENT ON A \$100 MILLION SHIP BY MORTGAGE INTEREST RATE AND PERCENT MORTGAGED  
25-YEAR LEASE PERIOD

Table 3-3. TOTAL COST OF LEASING A \$100 MILLION SHIP<sup>1</sup>  
OVER A 25-YEAR PERIOD, BY MORTGAGE INTEREST  
RATE AND PERCENT MORTGAGED

(Dollar Figures in Millions)

Mortgage Interest Rate (%)	Percent Mortgaged			
	50	60	70	80
5	175.0	140.4	105.7	71.1
6	182.4	149.9	116.1	83.0
7	190.3	158.7	127.2	95.6
8	198.7	168.8	139.0	109.1
9	207.6	179.5	151.4	123.3
10	216.9	190.6	164.4	138.2
11	226.6	202.3	177.9	153.6
12	236.6	214.3	192.0	169.7
13	246.9	226.7	206.5	186.3
14	257.6	239.5	221.4	203.3
15	268.5	252.6	236.6	220.7

<sup>1</sup>Includes Investment Tax Credit. See Table 3-1 for other input values for lease calculations.

rate on high-grade corporate bonds is about 12 percent. The lease cost to the Navy would be as follows:

Percent Mortgaged	Annual Lease Payment (\$Millions)	Total 25-Year Period (\$Millions)
50	9.5	236.6
60	8.6	214.3
70	7.7	192.0
80	6.8	169.7

These costs assume the input conditions described in the previous section. The actual payments would be semi-annual equal to one-half the annual payment.

Several points should be noted here. First, the total undiscounted cost of leasing the ship over the 25-year period could be substantially higher than the purchase (acquisition) cost of \$100 million.<sup>1</sup> As we shall discuss in greater detail later on, from the Navy's viewpoint the key issue is whether there are good reasons why the Navy would prefer to lease irrespective of its higher cost.

Second, the lease costs are highly sensitive to the percent mortgaged (or its complement, the percent held by equity owners). The difference between a 50 percent mortgage and an 80 percent mortgage is \$66.9 million or about two-thirds of the acquisition cost.<sup>2</sup> In the Navy Study of the TAKX procurement the percent mortgaged used in the analyses

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<sup>1</sup>Here we exclude government borrowing costs associated with the purchase.

<sup>2</sup>However, at a 12 percent interest rate the IRS regulations on restrictions on "profitability" noted earlier would constrain the mortgage percentage to less than 60 percent.

1  
was 57 percent (43 percent equity).<sup>1</sup> In the nine-tanker procurement the actual percent mortgaged was 75 percent (25 percent equity).<sup>2</sup> As will be demonstrated in Chapter IV, the mortgage percentage can have an important bearing not only on Navy costs but also on total Government costs, and may make leasing the best financial alternative to the Government. In any case, it would be advantageous to the Navy if it encouraged a large mortgage-holder participation.

The actual mortgage percent and interest rate for a particular lease transaction would, of course, depend upon market conditons just before the delivery of the ship, but it would be expected that mortgage bonds which would have the backing of the full faith and credit of the Federal Government could command a large proportionate mortgage holder participation at interest rates associated with the highest quality bonds of this nature.

The third point that should be noted is that the lease payments are in then-year dollars over the full term of the lease. The equity and mortgage holders typically take inflation into account in their respective (nominal) rates of return. Hence, the lease payment includes their estimates of the inflation rate. When comparing the total lease cost with the total purchase cost, the lease payments should be adjusted for inflation. The effects of inflation on the total lease cost are discussed later on in this chapter.

Finally, from the Navy's viewpoint, undiscounted, price-adjusted costs are the correct costs to use when comparing the Navy's direct lease costs to direct purchase costs. This

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<sup>1</sup>Reference [3], Appendix A.

<sup>2</sup>Reference [5], p. 15.

point, also, is discussed in more detail in the final section of this chapter.

**b. Sensitivity of Lease Costs to Interest Rates**

Figure 3-1 shows the relationship of lease payments to interest rates. Recall that the equity holders rate of return is fixed at 12 percent. Because this rate of return will vary with financial market and inflationary expectations, the reliability of the lease payment estimates may not be uniform throughout the full range of interest rates. However, in the interest rate range of 11-15 percent one would expect a high degree of reliability. Note that a substantial reduction in interest rates occurred from June 1982 to June 1983. Lease payments would decrease as follows:

Lease Payment (\$Millions)			
Percent Mortgaged	(14%)* June 1982	(12%)* June 1983	Percent Change
50	10.3	9.5	-7.8
60	9.6	8.6	-10.4
70	8.9	7.7	-13.5
80	8.1	6.8	-16.0

\*Approximate market rates.

The rate of decline would be greatest for the high mortgage percentages.

**c. Effect of the Investment Tax Credit**

As mentioned in Chapter II, there is a question as to whether the IRS would allow the lessors/owners to take the ten percent Investment Tax Credit. There is also the possibility that Congress could make all lease arrangements to Government



agencies ineligible for tax credits and accelerated depreciation, irrespective of the form of the contract.<sup>1</sup> Table 3-4 indicates the effect of eliminating the investment tax credit on annual lease payments and total lease costs. Financial market and tax law conditions in June 1983 are assumed. Notice that the effect is the same dollar amount for all mortgage percents. This is because the rate of return to the lessors on the net tax benefits is the same in each case. The mortgaged part of the lease has no effect on this aspect of the lease calculation. In any case, the absence of the ITC has a significant impact on the cost to the Navy. For a \$100 million ship the additional cost is \$1.86 million per year or \$46.5 million over the 25-year period.

**d. Inflation Adjustments<sup>2</sup>**

The lease payments paid by the Navy would be in then-year dollars; therefore, a comparison of the total cost of leasing with the purchase cost (as of the delivery date) should take into account the fact that the lease payments are in inflated dollars. Estimating the inflation rate over the 25-year period is, of course, problematic. The rate should be equivalent to that assumed in the nominal rates used by mortgage holders. Current (June 1983) economic conditions suggest a long-term rate of from three to five percent. In the summer of 1982 the long-term inflation rate prognosis was seven to ten percent, and long-term mortgage interest rates

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<sup>1</sup>A bill has been recently drafted by Representative Pickle (Democrat, Texas) that would make all forms of lease to the Federal Government ineligible for the ITC and accelerated depreciation.

<sup>2</sup>These adjustments should not be confused with the discounting process. Discount rates may or may not include a price-adjustment factor depending upon the nature of the analysis.

Table 3-4. EFFECT OF INVESTMENT TAX CREDIT (ITC) ON  
LEASE PAYMENTS AND TOTAL LEASE COST

\$100 Million Ship; 12 Percent Mortgage  
Rate<sup>1</sup>

(Dollar Figures in Millions)

Mortgage Percent	Annual Lease Payment			Total Lease Cost (25-Years)		
	With ITC	Without ITC	Change <sup>2</sup>	With ITC	Without ITC	Change
50	9.5	11.3	1.86	236.6	283.1	46.5
60	8.6	10.4	1.86	214.3	260.8	46.5
70	7.7	9.5	1.86	192.0	238.5	46.5
80	6.8	8.6	1.86	169.7	216.2	46.5

<sup>1</sup>See Table 3-1 for other input values used in the lease calculations.

<sup>2</sup>Determined from detailed figures.

reflected this higher percent. Table 3-5 presents inflation-adjusted total lease costs for various inflation rates and mortgage percentages. The lease costs are for a \$100 million ship, a 12 percent mortgage rate, 1983 tax laws, and other inputs shown in Table 3-1.

The figures indicate that the inflation-adjusted lease costs would be above the \$100 million purchase cost of the ships for inflation rates below five percent per year. The single exception occurs when the mortgage percent is 80 percent. Inflation rates above five percent yield leasing costs lower than the purchase cost depending upon the mortgage percent.

**e. Discounting Costs to the Navy**

We now enter into the murky area of applying discount rates to the cost streams. The position we shall take here is that from the Navy's viewpoint, the lease payment streams should not be discounted.<sup>1</sup> Discounting has two alternative purposes:

- (1) To account for Treasury Department financing costs, or
- (2) To compare alternative uses of resources for government and/or private sector programs.

The lease/purchase decision does not involve the latter type of comparison. The decision to commit resources has already been made; and funds will be made available through either the leasing or purchasing mechanism. Discounting, therefore, would be performed only to ascertain the relative financial costs. However, financial costs are not an issue for the

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<sup>1</sup>However, they should be adjusted for inflation.

Table 3-5. INFLATION-ADJUSTED TOTAL LEASE COSTS, BY  
INFLATION RATE AND MORTGAGE PERCENT  
\$100 MILLION SHIP; 12 PERCENT MORTGAGE RATE<sup>1</sup>  
(Dollar Figures in Millions)

Annual Inflation Rate (Percent)	Mortgage Percent			
	50	60	70	80
0	236.6	214.3	192.0	169.7
2	185.7	168.2	150.7	133.2
4	149.3	135.3	121.2	107.1
5	135.0	122.3	109.6	96.9
6	122.8	111.3	99.6	88.1
8	103.0	93.3	83.6	73.9
10	88.0	79.7	71.4	63.1

<sup>1</sup> See Table 3-1 for other inputs used in computing lease costs. The ITC is allowed.

Navy, because these costs are not part of budgetary considerations.

### C. CONCLUSIONS

From the Navy's viewpoint, only inflation-adjusted direct costs of purchasing or leasing should be used. The key issue for the Navy is: which appropriation accounts should be used for the acquisition of the ship. If specific construction (SCN) funds were available, the Navy would undoubtedly opt for direct purchase, because there are no operational or (as shown in the previous section) direct cost advantages to leasing except when the expected inflation rate is high. Moreover, there are contingency costs and other uncertainties associated with leasing (discussed in Chapter V) that make leasing less attractive. However, if the Navy is faced with a situation where specific SCN funds are not available and the inclusion of the program in the construction budget would force out higher priority shipbuilding programs, then the lease option might become more attractive in spite of its higher cost.<sup>1</sup>

The Navy decision, therefore, must be based upon a judgment as to whether a leasing program would help accomplish the Navy's ship acquisition objectives in spite of potentially higher long-term price-adjusted direct costs. From the Navy's viewpoint, Government leasing costs might enter into its decision process only if these costs could be shown to be less than Government purchasing costs; i.e., if lower Government leasing costs could be used as a justification for a leasing program. The issue as to whether or not Government leasing costs can ever be lower than purchasing costs is examined in the next chapter.

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<sup>1</sup>This, of course, assumes that O&M funds would be available.

## Chapter IV

### LEASE VERSUS PURCHASE COSTS: THE GOVERNMENT'S POINT OF VIEW

In this chapter it is assumed that the Navy would be allowed to build-and-charter a ship under the "service contract" arrangement described in Chapter II. The lessors, therefore, would be allowed to use the Investment Tax Credit (ITC) and the Accelerated Cost Recovery System (ACRS) factors in effect under 1983 tax laws. The issues examined here are:

1. How should the Government's cost (Navy plus Treasury) of purchasing a ship be evaluated when comparing such costs to lease costs?
2. How should the lease (capital-hire) portion of the service contract be evaluated with respect to the Government cost?<sup>1</sup>
3. What discount rate should be used in the evaluation?

#### A. RECENT CONTROVERSY OVER THE ISSUES

These issues have become quite controversial since the Navy introduced the TAKX program. The Navy's approach to the costing issue, as presented in two Navy studies<sup>2</sup>, has been strongly criticized by the staff of the Joint Committee on Taxation (JCT); this staff offered a substitute method.<sup>3</sup> The IDA approach in an earlier version of this report was similar

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<sup>1</sup>It is assumed that the operating cost portion of the contract would be the same under civilian or Navy control.

<sup>2</sup>References [3] and [4].

<sup>3</sup>Reference [12].

to that of the Navy studies and had it been available to the JCT staff, it probably would have been criticized on similar grounds.<sup>1</sup> The JCT staff and the Navy/IDA methodologies have been further criticized by public finance economists who offer yet another method.

Discounting methods also have become controversial. The OMB discounting concept<sup>2</sup>--based upon an average rate of return on private investment before taxes but after price-level adjustments--is regarded by some analysts as an incorrect basis for evaluating leasing programs. The OMB concept, it is argued, is designed for evaluating whether or not to engage in a particular program involving the use of physical resources. In the case of leasing program, however, it is taken as "given" that the resources (e.g., ships) will be acquired; leasing is simply an alternative method of financing the acquisition of the ships. The appropriate discount rate, therefore, is one which is based upon Treasury financing costs, e.g., yields on long-term Treasury securities.

For the case where leasing is regarded as an alternative form of financing, a specific discount rate has not been established. The following bases have been proposed:

- Variable rate based upon current Treasury borrowing rates on long-term bonds with maturities equal to the term of the lease.
- Weighted average of US Treasury security yields, the weighting to correspond to the amortization schedule in the leasing contract.

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<sup>1</sup>A recent Government Accounting Office (GAO) report (see Reference [17]) was critical of both the Navy and IDA methodologies. GAO adopted approximately the same method as the JCT staff.

<sup>2</sup>Reference [15].

- Average yield on marketable Treasury obligations with remaining maturities comparable to the period of the analysis.<sup>1</sup>

Clearly, Government leasing cost methodologies need to be re-examined in the light of these recent developments. The remaining sections of this chapter are devoted to a discussion of the various methodologies and an evaluation of their analytical consequences. We begin this discussion with an analysis of purchasing costs.

## B. GOVERNMENT FINANCING COST

### 1. Financing the Purchase of a Ship

As discussed in Chapter III, we define purchasing costs as those costs directly associated with acquiring the ship, and we assume that the Navy's acquisition cost is the same as that of the lessors/owners. When the overall Government cost, however, an additional cost must be included. This is the cost (to the Treasury) of financing the purchase. Unfortunately, the measurement of this cost is not a simple matter.

The Treasury finances capital acquisitions from two sources of funds: (1) revenue received from taxes and from various Government business-like operations and (2) borrowings. Usually, special securities such as mortgage bonds ear-marked to a specific acquisition, such as a ship, are not issued. Rather, a ship acquisition would be merged into the general financing requirements of the Treasury. Moreover, actual outlays for the purchase are spread out over the ship's construction period and involve many transactions,

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<sup>1</sup>Reference [17], Appendix VII. GAO, however, would substitute this rate for the OMB circular A-94 rate.



so that the total Treasury debt outstanding is increased gradually rather than at a specific point of time. Thus, in actual practice, there is no specific accounting for financing costs associated with specific purchases; therefore, such costs for specific projects must be estimated.

Several questions immediately arise:

- (1) How much of the ship acquisition cost should be financed from general revenues and how much from Treasury borrowing?
- (2) Should the debt portion of the acquisition cost be amortized?
- (3) Should revenue reflows from bondholders' income taxes on interest earnings be considered?

Here, again, there is much room for controversy.

Some economists answer the above questions as follows: First, the entire ship acquisition cost should be regarded as increment to the national debt because tax revenues may not increase to cover the additional expenditures. Tax revenues are subject to economic conditions and are usually independent of the nature of the expenditures.<sup>1</sup> Second, it can be expected over the long-term that the national debt will not decline in absolute terms, so that the Treasury will finance current debt virtually in perpetuity. At best, the principal will be refinanced at the end of the period such as is the case with most Treasury securities. Third, it is very difficult to establish the tax rate on holders of Treasury securities because many are tax exempt or in low tax brackets. Most certainly, the corporate tax rate of 46 percent would not be applicable. Fourth, in any case, an

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<sup>1</sup>Trust funds, e.g. the Highway Trust Fund, are an exception to this. There is, of course, no trust fund specifically ear-marked for military expenditures.

opportunity cost equal to the Treasury borrowing rate should be added to the general revenue portion because use of these funds for one project may force another project to be financed or abandoned completely.

In contrast to the above answers, others have argued that:<sup>1</sup>

- (1) Financing costs should be applied only to the proportion of the federal budget that must be financed from borrowing. If, for example, 20 percent of the budget must be financed from borrowing, this same percent should be applied to the ship acquisition cost.
- (2) The debt portion of the ship acquisition should be amortized over the term of the bond which should be assumed to be the same as the term of the lease.
- (3) Revenue reflows (i.e., revenue from taxes on interest earnings) should be accounted for at the corporate rate of 46 percent.

Table 4-1 shows the range of possible answers for the undiscounted total purchase cost of a \$100 million ship. The total cost would be \$375 million if it is assumed that (1) 100 percent of the purchase cost would be financed; (2) there would be zero tax reflow; (3) the principal would be paid back at the end of the 25-year period. This is the highest cost estimate. In contrast, the cost would be only \$118.1 million if it is assumed that (1) only 20 percent would be financed (80 percent paid out of general revenue); (2) there would be a 46 percent tax reflow; and (3) the principal would be amortized over the 25-year period. Depending upon the financing assumptions, therefore, the purchase cost could range from \$118.1 million to \$375 million, a difference of nearly \$256 million!!

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<sup>1</sup>Reference [12], p. 32, et seq.

Table 4-1. UNDISCOUNTED TOTAL GOVERNMENT COST OF PURCHASING AND FINANCING A \$100 MILLION SHIP, BY ESTIMATING METHOD AND PERCENT FINANCED

TREASURY SECURITY INTEREST RATE = 11 PERCENT<sup>1</sup>

Estimating Method	Percent Financed				
	100	80	60	40	20
ZERO TAX REFLOW					
Principal paid back at end of 25-year period	375.0	320.0	265.0	210.0	155.0
Principal amortized over 25-year period	296.9	257.5	218.1	178.7	139.1
46 PERCENT TAX REFLOW					
Principal paid back at end of 25-year period	248.5	218.8	189.1	159.4	129.7
Principal amortized over 25-year period	190.6	172.5	154.3	136.2	118.1

<sup>1</sup>Approximate current (June 1983) average rate on long-term Treasury bonds.

The amortization method might be excluded, however. The Treasury does not amortize the debt in its debt instruments, nor has it been amortizing the total national debt. Exclusion of this method limits the needed input assumptions to two variables, the percent financed and the degree of tax reflow. This does not help much, however, since the range of estimates now becomes \$129.7 million to \$375.0 million, still a difference of about \$245 million! Furthermore, if one assumes that the principal is refinanced at the end of each debt period, the undiscounted value of payments becomes infinite. Such an answer would be totally useless to an attempt to value the cost of purchasing.

How can this vast difference in results be resolved? As will be shown below, the discounting process normalizes the purchase cost so that it can be compared to the discounted lease cost; however, when one wishes to consider undiscounted dollars, a subjective judgment still must be made as to what the actual purchase cost would be.

## 2. Discounting Purchase Costs

The discounting process involves finding the original acquisition cost when given the stream of purchase outlays or the total cost over the period (including financing). This is shown most clearly in the compound interest formula.

$$T = A(1+r)^n$$

where T is the total cost including the financing, A is the original amount (e.g. acquisition cost), r is the interest rate, and n is the number of years. In discounting we are

interested in solving for the original amount, A (present value), given the values of the other variables; i.e.,

$$A = \frac{T}{(1+r)^n} .$$

For example, assume a \$100 million investment, and we wish to know the total accumulation if we invested at 11 percent per year compounded annually over 25 years. The accumulated total, T, would equal

$$T = 100 (1+.11)^{25} = 1,359,$$

and reversing the process shows that the present value of the accumulated total, T, would be

$$A = \frac{1,359}{(1+.11)^{25}} = 100 .$$

When financing a \$100 million ship using standard Treasury bonds, interest on the bonds is paid semi-annually (not compounded), and the \$100 million is paid back at the end of the period. The formula for determining the total cost including the financing is

$$\begin{aligned} T &= nrA + A \\ &= A(nr+1) . \end{aligned} \tag{4.1}$$

Solving for A we get

$$A = \frac{T}{nr+1} . \tag{4.2}$$

For example, the \$375 million total cost in Table 4-1 was determined using equation (4.1) as follows:

$$\begin{aligned} T &= 100 (25 \times .11 + 1) \\ &= 100 \times 3.75 \\ &= 375 . \end{aligned}$$

Suppose we were given the 375, the interest rate (discount rate) and the number of years, n, and we wish to find the original amount. Then

$$A = \frac{T}{nr+1} = \frac{375}{25 \times .11 + 1} = \frac{375}{3.75} = 100 .$$

If it is assumed that interest income will be taxed at a rate, R, the formula for determining total cost is

$$T = Anr + A - RAnr . \quad (4.3)$$

This is called the "tax reflow" method. Note that the term Anr represents the interest income. This equation can be rearranged so that

$$\begin{aligned} T &= A[nr(1-R) + 1] \\ &= A (nE + 1) \end{aligned} \quad (4.4)$$

where  $E = r(1-R)$  is the "effective government borrowing rate". Solving for A we get

$$A = \frac{T}{nE + 1} . \quad (4.5)$$

To illustrate the tax reflow method, let  $A = 100$ ,  $r = 11\%$ ,  $n = 25$  and  $R$  (the income tax rate of the mortgage holders) = 46%. Then

$$\begin{aligned} T &= 100 (25 \times .11 (1-.46) + 1) \\ &= 100 (25 \times .11 \times .54 + 1) \\ &= 100 (25 \times .0594 + 1) = 248.5 . \end{aligned}$$

The effective borrowing rate in this case is 5.94 percent. Applying the discounting formula (4.5) to the above results,

$$\begin{aligned}
A &= \frac{T}{nE + 1} \\
&= \frac{248.4}{25 \times .0594 + 1} \\
&= \frac{248.5}{2.485} = 100 .
\end{aligned}$$

Thus, if the appropriate discounting formula, interest rates and time periods are used, the present value, A, will always equal the acquisition cost. The analyst is free to make assumptions about the financing of purchase that appear appropriate for the specific transaction. As long as the discount and payments flows are properly adjusted to reflect the tax-reflow assumption, the present value of the transaction will equal A, the purchase price.

### 3. Financing the Lease

Exactly the same financing issues apply to the financing of the lease payments. The Government must make the lease payments out of general revenues and/or borrowings. Therefore, a financing cost should be added to the lease payment based upon whatever revenue/debt ratio is assumed for the purchase. In addition, the tax reflow from the Treasury bond holders should be considered. Fortunately, the same discounting principles used in discounting the purchase costs apply to leasing costs. The discounting process neutralizes the Government financing costs associated with leasing.

### C. GOVERNMENT COST OF LEASING: METHOD I

We shall present two methods for calculating the Government cost of leasing:<sup>1</sup>

- I. Account for all Government revenue losses and gains. This is the approach taken in the Navy Study and IDA in an earlier version of this report.
- II. Account for lease payments, the investment tax credit, and the net effects of accelerated depreciation. This is the "tax subsidy" approach.

This section discusses Method I. Method II is presented in Section D.

#### 1. Method I: General Description

The general structure of Method I is set out in Table 4-2. In Method I all revenue flows are taken into consideration. Actual calculations are on a quarterly basis; the table shows only the sum of each set of quarterly flows.

In a leasing program involving a leveraged lease, the Government incurs costs not only as a result of the lease payments but also from the tax credits and tax deductions taken by the lessors/owners. As shown in Table 4-2, these costs include:

- Depreciation (ACRS) deductions taken during the first five years,
- Investment Tax Credit (ITC) taken in the first year,
- Mortgage interest deductions taken throughout the period but heaviest during the earlier years, and
- Other deductions, particularly closing costs amortized over the full period.

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<sup>1</sup>We shall also demonstrate that JCT/GAO method is quite similar to Method I but uses different assumptions regarding the treatment of mortgage holders income tax.



Table 4-2. UNDISCOUNTED TOTAL GOVERNMENT COST OF LEASING  
A \$100 MILLION SHIP USING METHOD I <sup>1</sup>  
(Millions of Dollars)

Category	Amount
A. LEASE PAYMENT	214.3
B. REVENUE LOSSES FROM TAX DEDUCTIONS	
1. Accelerated Cost Recovery (ACRS)	43.7
2. Investment Tax Credit (ITC)	10.0
3. Mortgage Interest Paid to Mortgage Holders	60.0
4. Other (e.g. lease packager's fees)	<u>2.6</u>
Subtotal	116.3
C. REVENUE GAINS FROM INCOME TAXES	
1. Lessors' Income Taxes	(98.6)
2. Mortgage Holders Income Taxes	(60.0)
3. Other Parties (e.g. lease packager)	<u>(2.6)</u>
Subtotal	<u>(161.2)</u>
TOTAL GOVERNMENT COST	169.4

<sup>1</sup> Assumes 12 percent mortgage rate; 60 percent mortgage; 46 percent income tax rate for both equity and mortgage holders. See Table 3-1 for other input values used in the calculations.

However, the Government also gains revenue over the 25-year period from income taxes paid by

- The lessors on the net income from the lease,
- Mortgage holders on interest income from the mortgage bonds, and
- Other parties from income on fees, etc.

Total Government cost, therefore, is the net of these lease costs and revenue losses and gains.

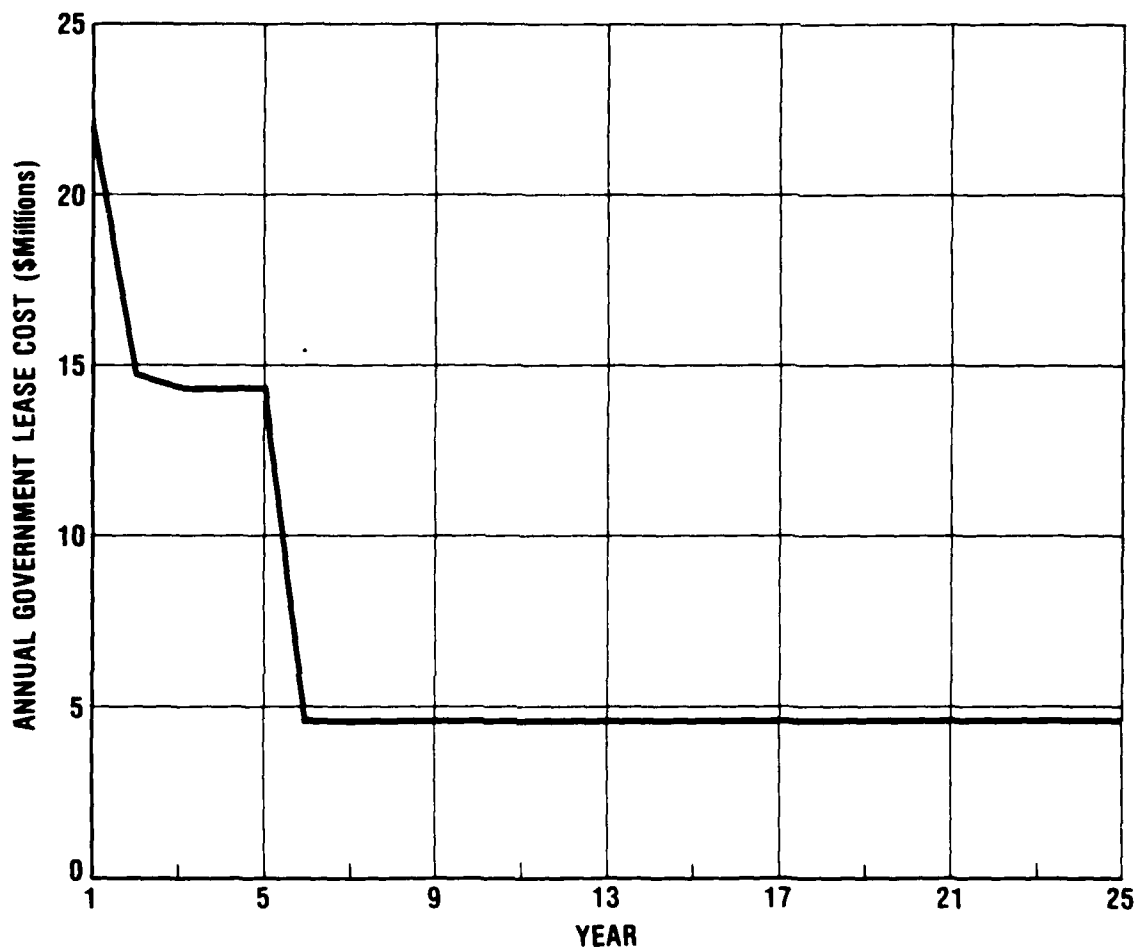
It is important to recognize that these flows are not uniform throughout the period. Figure 4-1 shows the net costs to the Government on an annual basis. Notice that the highest cost is in the first year. This is the effect of the ITC and the first year of the ACRS tax credit. Years two through five are high because of the remaining ACRS tax credits. The remaining years reflect only the net effect of lease payments, interest, and other income and expenses.<sup>1</sup>

An underlying assumption of this method is that the Navy's leasing program would stimulate additional investment by the private sector so that the net effect of the tax losses and gains would be an additional cost to the Government. If the lease program involved a displacement of private sector investment in the exactly the same debt/equity proportions, there would be no net tax effect on the Government and the Government's cost would be simply the lease cost.<sup>2</sup> It is our opinion that the degree or nature of displacement cannot be measured; so the issue is unresolvable. When using Method I,

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<sup>1</sup>The shape of the curve will vary according to the assumption regarding the mortgage holders income tax rate. In this example it is assumed that both the lessors and mortgage holders are taxed at 46 percent income tax rate.

<sup>2</sup>See Reference [14], pp. 9-10 for a discussion of the displacement issue.



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Figure 4-1. UNDISCOUNTED ANNUAL GOVERNMENT COST OF LEASING  
A \$100 MILLION SHIP USING METHOD I

we prefer to account for all costs assuming that new investment will take place, so that the effects of varying the assumptions regarding displacement can be measured.<sup>1</sup>

## 2. Discounted Lease Versus Purchase Costs Using Method I

As explained earlier an immediate advantage to discounting is that the purchase cost is normalized to the acquisition cost and financing costs associated with the lease payments are neutralized.<sup>2</sup> In our analyses the acquisition cost is \$100 million; therefore, this is the discounted total purchase cost to which all discounted total lease costs are compared.

Discounted total lease costs are determined from the following formula:

$$T = \sum_{i=1}^n \frac{G_i}{(1+r)^i} \quad (4.6)$$

where  $G_i$  is the Government cost of leasing for period,  $i$ , and  $r$  is the assumed discount rate. Here we use Method I for computing the Government cost and have computed these costs on a quarterly basis.<sup>3</sup>

As will be demonstrated below, discounted total costs are highly sensitive to the discount rate; so the assumed rate is

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<sup>1</sup>Complete displacement in the same equity/debt proportions is, after all, only one of an infinite variety of displacement possibilities.

<sup>2</sup>See Section IV A.2. This assumes that the ship is financed in a lump sum at the delivery date. Actually, outlays would be made according to the progress payment schedule during the construction period and financing would begin at the first progress payment.

<sup>3</sup>The discount rate,  $r$ , is translated to a quarterly rate which, when compounded over four quarters, will yield the annual rate.

an important factor in lease versus purchase cost comparisons. The analysis examines the effects on cost comparisons of two discount rate bases:

- a. The ten percent rate specified by the Office of Management and Budget (OMB) in Circular A-94.<sup>1</sup>
- b. A variable after tax rate which is based upon the "Effective Government Borrowing Rate."

**a. OMB Discount Rate Analysis**

Table 4-3 presents discounted total cost of leasing a \$100 million dollar ship for the OMB rate of ten percent and for various assumptions as to the mortgage holders income tax rate and the percent of the acquisition cost that is mortgaged. Because the discounted purchase cost is always \$100 million, any number less than 100 means that the discounted lease cost is less than the purchase cost. The solid line delineates the dividing points where leasing costs are lower than purchasing costs.

The figures show that much would depend upon the average tax rate of the mortgage holders. If most of the mortgage holders were non-profits or low-income individuals, the average tax rate might be less than 20 percent.<sup>2</sup> Under these conditions the discounted total Government cost of leasing would be higher than for purchasing (greater than \$100

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<sup>1</sup>Reference [15].

<sup>2</sup>See Appendix C for a list of the original mortgage holders in the nine-tanker procurement. The Joint Committee on Taxation staff, in effect, assumed that 57 percent would be mortgaged, and the mortgage holders tax rate would be zero. The JCT concluded that the discounted purchase cost would be 11.7 percent higher than for leasing (Reference [13], p. 20). Our figures show that the purchase cost would be roughly 13 percent higher for 60 percent mortgaged.

Table 4-3. DISCOUNTED TOTAL COST OF LEASING A \$100 MILLION SHIP, BY MORTGAGE HOLDERS TAX RATE AND PERCENT MORTGAGED

DISCOUNT RATE = 10 PERCENT  
(Dollar Figures in Millions)

Mortgage Holders Tax Rate (Percent)	Percent Mortgaged			
	50	60	70	80
46	90.8	86.4	81.9	77.5
40	93.7	89.9	86.0	82.2
30	98.6	95.7	92.9	90.0
20	103.5	101.6	99.7	97.8
10	108.4	107.4	106.5	105.6
0	113.2	113.3	113.3	113.4

million); otherwise the Government cost of leasing would be lower than purchasing.

The question now arises as to whether or not the OMB discount rate is the appropriate rate to use in this type of analysis. It is an interesting historical fact that for the nine-tanker build-and-charter program, which also involved leveraged leasing, the Navy and the Assistant Secretary of Defense (Installations and Logistics) took the position that the ten percent OMB rate was the correct rate when determining the discounted total cost of leasing.<sup>1</sup> At that time the GAO disagreed with the Department of Defense and cited the rate in OMB Circular A-76 which at that time was six percent.<sup>2</sup> The basis for the OMB Circular A-94 rate is the average return on private investment before taxes and after inflation. At that time the basis for the OMB Circular A-76 rate was the Treasury Department borrowing rate.<sup>3</sup> Since that time, the rate in OMB Circular A-76 has increased to ten percent.<sup>4</sup>

It is not surprising, therefore, that many analysts--including those writing the two Navy studies and the earlier version of this IDA report--would use ten percent as the appropriate discount rate. Because these OMB circulars agree as to the ten percent rate, and they are the only directives

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<sup>1</sup>Reference [5], p. 34.

<sup>2</sup>Ibid., p. 2.

<sup>3</sup>Ibid.

<sup>4</sup>Reference [16], p. 8. The basis for this rate is not stated in the Circular except to state that it is "...the opportunity cost of capital investments..." (same page).

available<sup>1</sup> and the Department of Defense has taken a previous position that the Circular A-94 rate is appropriate, there was little reason to presume that any other rate would be accepted.<sup>2</sup>

From a technical standpoint, however, none of the circulars apply directly to leveraged leasing procurements. If leasing is regarded as an alternative method of financing the acquisition of a ship, the basis for the discount rate should reflect Treasury financing costs. In addition, since lease costs are in then-year dollars, the discount rate should be based on "nominal" interest rates, i.e., rates which have not been adjusted for inflation. Thus, if the ten percent OMB discount is no longer to be regarded as sacrosanct, the way is open for the introduction of a new basis for discounting.<sup>3</sup>

**b. Variable After Tax Discount Rate Analyses**

Table 4-4 presents the discounted total Government costs where Method I is used for determining the costs and the discount rates are based on the current (June 1983) approximate average Treasury bond interest rate of 11 percent. An additional factor is introduced, however.

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<sup>1</sup>OMB Circular A-104 cites a seven percent rate (after inflation adjustment) based on the internal rate of return on all property leased from the private sector. This, however, is specifically oriented to real property and involves tax adjustments which would not be applicable to this type of analysis.

<sup>2</sup>Scores of articles have been written on the subject of the proper discount rate to use when performing cost/benefit analyses for government programs. See, for example, References [19] and [20].

<sup>3</sup>We emphasize the term "basis," because the rate itself would depend upon the particular Treasury security interest rate(s) selected and may vary according to financial market conditions.



Table 4-4. DISCOUNTED TOTAL COST OF LEASING A \$100 MILLION SHIP, BY MORTGAGE HOLDERS TAX RATE AND PERCENT MORTGAGED<sup>1</sup>

DISCOUNT RATE = EFFECTIVE GOVERNMENT BORROWING RATE  
(Dollar Figures in Millions)

Mortgage Holders Tax Rate (Percent)	Eff. Govt. Borrowing Rate <sup>2</sup> (Percent)	Percent Mortgaged			
		50	60	70	80
46	5.94	113.6	107.3	101.1	94.9
40	6.60	112.7	107.6	102.4	97.3
30	7.70	111.4	107.9	104.3	100.8
20	8.80	110.1	108.0	105.8	103.7
10	9.90	108.9	108.0	107.0	106.1
0	11.00	107.8	107.9	108.0	108.1

<sup>1</sup>12 percent mortgage rate. See Table 3-1 for other input values used in the calculations.

<sup>2</sup>Based on 11 percent Treasury bond rate. See text for discussion of computation method.

Because Method I accounts for tax reflows back to the Government by way of income taxes paid by the lessors, lenders and other parties to the lease transaction, the costs are net of all tax transactions. The discount rate, therefore, should be an after-tax reflow rate. Recall in Section B.2 of this chapter that the "Effective Government Borrowing Rate" concept was introduced. This was defined as follows:

$$E = r(1-R)$$

where  $r$  is the Treasury bond interest rate and  $R$  is the mortgage holders income tax rate. If  $r = .11$  and  $R = .46$ ,

$$E = .11 (1-.46) = .11 \times .54 = .0594.$$

As shown in Table 4-4, the effective rate varies with the assumed mortgage holders income tax rate. If it is assumed that there is no tax reflow from mortgage holders, the effective rate is equal to the Treasury bond rate.

The results in Table 4-4 give an entirely different pattern from that in Table 4-5. Here, there are only two cases when the Government cost of leasing is lower than the purchase cost. Both of these cases occur when the percent mortgaged is at 80 percent and the mortgage holder tax rate is 40 percent or higher. By interpolation it can be shown that for a 46 percent mortgage holders tax rate, the discounted total Government cost is equal to the purchase cost at a percent mortgaged of about 72 percent (28 percent equity).

When calculating the figures for Table 4-4, we assumed that the interest rate on the mortgage was 12 percent and the Treasury bond rate was 11 percent; i.e., there would be an interest rate differential of one percent between the Treasury

Table 4-5. DISCOUNTED TOTAL GOVERNMENT COST OF LEASING  
A \$100 MILLION SHIP, BY MORTGAGE HOLDERS TAX  
RATE AND PERCENT BORROWED

11 PERCENT MORTGAGE RATE; 11 PERCENT TREASURY BOND RATE<sup>1</sup>  
(Dollar Figures in Millions)

Mortgage Holders Tax Rate (Percent)	Effective Government Borrowing Rate (Percent)	Percent Mortgaged		
		60	70	80
46	5.94	104.0	97.2	90.4
40	6.60	104.0	98.3	92.5
30	7.70	103.9	99.8	95.6
20	8.80	103.8	101.0	98.1
10	9.90			100.2

<sup>1</sup>See Table 3-1 for other input values used in calculating the lease payment.

bond rate and the mortgage rate. In Table 4-5 we assume that the mortgage rate is equal to the Treasury bond rate. This would be the case if investors regarded the mortgage as having the same risk and tax advantages as a Treasury bond. The table shows only the border cases where lease costs become lower than purchase costs.

It is clear that the interest rate on the mortgage and the percent of the acquisition cost that would be mortgaged are major factors in the lease cost to the Government. For the assumptions used in Table 4-5, the breakeven point is below 70 percent mortgage for mortgage holder tax rates of 30 percent or more. Recall that the nine-tanker procurement involved a 75 percent mortgage.<sup>1</sup>

### 3. The JCT/GAO Method

We are now at the point where we can demonstrate that the JCT/GAO method is a special case of Method I (using the variable discount rate) where the mortgage holders tax rate is assumed to be zero. As shown in Table 4-4, when it is assumed that the mortgage holders tax rate is zero, the Effective Government Borrowing Rate is equal to the Treasury bond rate. This has the same effect as when it is assumed, as in the JCT/GAO method, that the mortgage holders tax reflows are equal for both the purchase and the lease and the discount rate is equal to the Treasury bond rate (or average Treasury security rate).

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<sup>1</sup>Reference [5], p. 15.

In the following tabulation we have used the same input assumptions as for GAO's base case:<sup>1</sup>

	GAO	Method I
<u>Inputs</u>		
Ship Acquisition Cost	\$178.23 million	\$178.23 million
Percent Mortgaged	57%	57%
Loan Interest Rate	11%	11%
Equity Rate of Return (After Tax)	11.34%	11.34%
Sinking Fund (Reinvestment) Rate	7%	7%
Discount Rate	11.0%	11.0%
<u>Results</u>		
Annual Lease Payment	\$15.008 million	\$15.074 million
Discounted Government Cost	\$190.725 million	\$185.070 million
Percent Greater Than Purchase Cost	7.01%	3.8%

There are, of course, differences in the details of the methodologies. For example, the GAO method discounts on an annual basis, whereas Method I discounts on a quarterly basis. Nevertheless, the figures are close enough to demonstrate our point that Method I and the GAO method yield similar results when using the same assumptions.

#### D. GOVERNMENT LEASING COST: METHOD II

##### 1. Method II: General Description

As Table 4-6 indicates, the structure of Method II is quite simple. The total Government cost of leasing is the sum of the lease payments plus the Investment Tax Credit plus net revenue losses from tax deductions taken by the lessors for

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<sup>1</sup>Reference [17], pp. 15-16.

Table 4-6. UNDISCOUNTED GOVERNMENT COST OF LEASING A \$100  
MILLION SHIP USING METHOD II<sup>1</sup>

(Millions of Dollars)

Category	25-Year Total
A. LEASE PAYMENTS	214.3
B. NET REVENUE LOSSES FROM TAX CREDITS TAKEN BY THE LESSORS	
1. Investment Tax Credit (ITC)	10.0
2. Accelerated Cost Recovery (ACRS)	43.7
3. Normal Depreciation of Asset	<u>(46.0)</u>
TOTAL GOVERNMENT COST	222.0

<sup>1</sup>Assumes 12 percent mortgage rate; 60 percent mortgage percent. See Table 3-1 for other input values used in the calculations.

accelerated depreciation. Revenue losses include the Investment Tax Credit and the tax on net difference between the the ACRS deductions and deductions under "normal" depreciation of the asset. "Normal" is assumed here to be a straight-line depreciation taken over the lifetime of the asset.<sup>1</sup> The slight difference between the total tax on ACRS deductions and the "normal" deductions occurs because the 1983 tax laws require that if the ten percent ITC is taken, the depreciation basis for the ACRS credits must be reduced by one-half of the ITC. In this case the depreciation basis for the ACRS (in millions of dollars) is  $100 - 1/2 (10) = 95$ .

Stated mathematically, the Method II formula for obtaining the undiscounted values for a period,  $i$ , is

$$T_i = L_i + I_i + R [(A - 1/2 I) F_i - \frac{(A-s)}{n}]$$

where

- $T_i$  : Total Government cost in period  $i$
- $I$  : Total investment tax credit
- $I_i$  : Amount of the investment tax credit in period  $i$
- $A$  : Acquisition cost
- $L_i$  : Lease payment for period  $i$
- $F_i$  : ACRS factor for period  $i$
- $R$  : Lessors' income tax rate
- $s$  : The scrap value of the asset
- $n$  : Total number of periods .

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<sup>1</sup>The concept of "normal" depreciation is discussed later.

The undiscounted total Government cost of leasing is simply

$$T = \sum_{i=1}^n T_i = \sum_{i=1}^n (L_i + C_i)$$

where  $C_i$  is the collection of terms involving the tax deductions. The discounted total Government cost of leasing is

$$T = \sum_{i=1}^n \frac{T_i}{(1+r)^i} = \sum_{i=1}^n \frac{L_i}{(1+r)^i} + \sum_{i=1}^n \frac{C_i}{(1+r)^i}$$

where  $r$  is the discount rate.

It should be noted that for a particular acquisition cost, the tax deductions ( $C_i$ ) are fixed. Therefore, the total Government cost will vary only with the lease cost. This applies to both undiscounted and discounted costs. Thus, under Method II, the total Government cost of leasing is sensitive to the input values associated with determining the lease cost. Table 4-7 shows the detailed calculations on an annual basis.<sup>1</sup> The graph of the annual figures is provided in Figure 4-2.

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<sup>1</sup>Our computer program calculates all values on a quarterly basis, including the discounted values.



Table 4-7. UNDISCOUNTED ANNUAL GOVERNMENT COST OF LEASING A  
\$100 MILLION SHIP USING METHOD II

(Dollar Figures in Thousands)

Year	Lease Payment	ITC	ACRS	Normal Depreciation <sup>1</sup>	Total Government Cost
1	8,572	10,000	6,555	1,840	23,287
2	8,572		9,614	1,840	16,346
3	8,572		9,177	1,840	15,909
4	8,572		9,177	1,840	15,909
5	8,572		9,177	1,840	15,909
6	8,572			1,840	6,732
7	8,572			1,840	6,732
8	8,572			1,840	6,732
9	8,572			1,840	6,732
10	8,572			1,840	6,732
11	8,572			1,840	6,732
12	8,572			1,840	6,732
13	8,572			1,840	6,732
14	8,572			1,840	6,732
15	8,572			1,840	6,732
16	8,572			1,840	6,732
17	8,572			1,840	6,732
18	8,572			1,840	6,732
19	8,572			1,840	6,732
20	8,572			1,840	6,732
21	8,572			1,840	6,732
22	8,572			1,840	6,732
23	8,572			1,840	6,732
24	8,572			1,840	6,732
25	8,572			1,840	6,732
TOTAL	214,300	10,000	43,700	46,000	222,000

<sup>1</sup>Assumes zero scrap value at the end of the 25-year period.

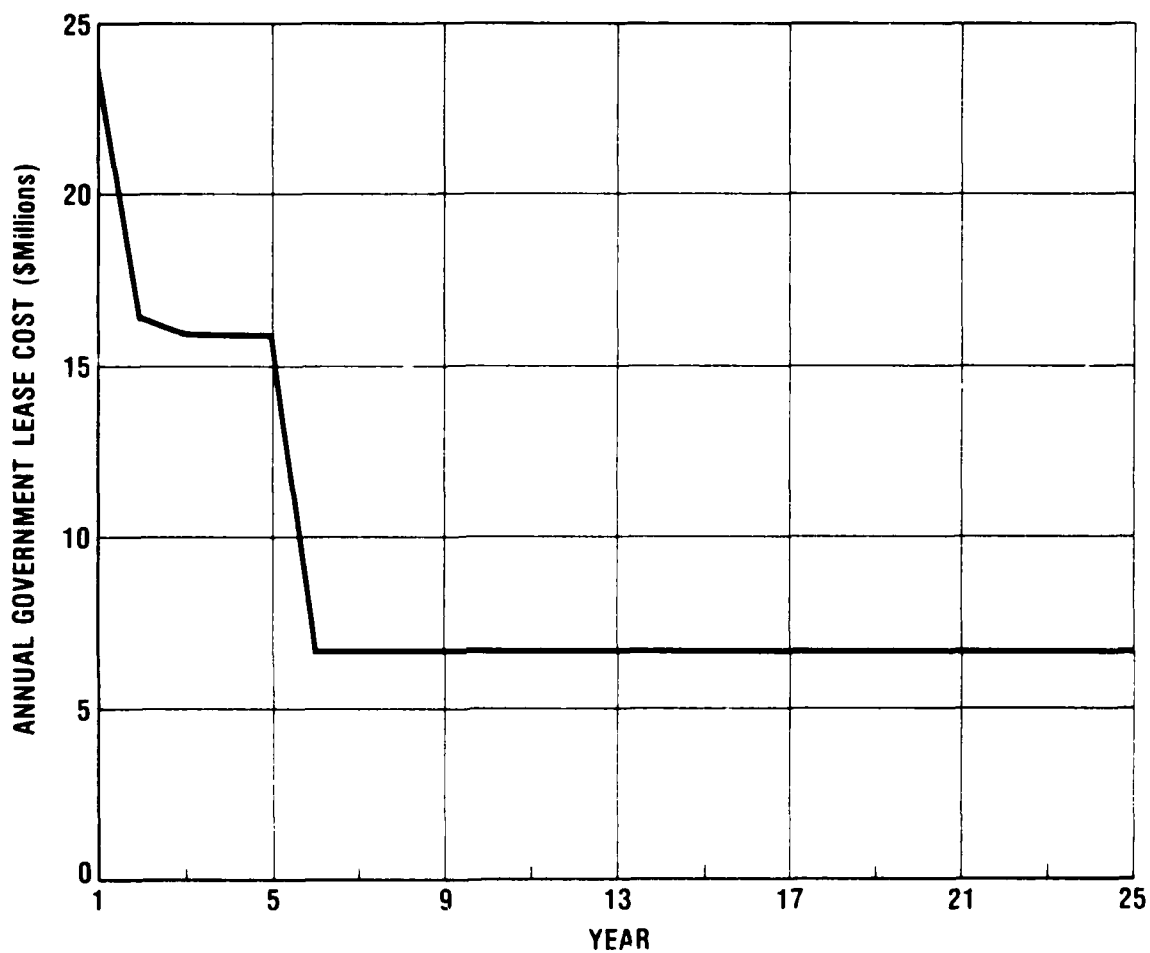


Figure 4-2. UNDISCOUNTED ANNUAL GOVERNMENT COST OF LEASING  
A \$100 MILLION SHIP USING METHOD II

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ALTERNATIVE METHODS FOR THE ANALYSIS OF LEASE/PURCHASE  
OPTIONS IN NAVAL A. (U) INSTITUTE FOR DEFENSE ANALYSES  
ALEXANDRIA VA J D WELLS ET AL. NOV 83 IDA-P-1665-REV

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MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

## 2. Method II Rationale

Method II takes the "tax expenditure" or "tax subsidy" approach in evaluating the lease costs.<sup>1</sup> Tax subsidies occur when additional costs to the Government occur as the result of "special" tax provisions as compared to "normal" or "reference" provisions of the income tax structure.

In leveraged lease arrangements the ITC is clearly a tax subsidy because such a credit is not part of the basic income tax structure.<sup>2</sup> Whether or not the ACRS involves a tax subsidy is more controversial. The Office of Management and Budget analysts take the position that the ACRS provisions do not involve a tax subsidy because

"...The ACRS provisions now constitute the general income tax rules [for determining how the cost of depreciable assets is recovered]. To see this, one need only ask: If ACRS is special, what is the general tax accounting rule to which ACRS is an exception..."<sup>3</sup>

Other financial economists would argue that the ACRS should be compared to the economic depreciation on an asset, i.e., the true reduction in the value of the asset.<sup>4</sup>

None of the other deductions, such as mortgage interest, would involve a tax subsidy because they would be part of the "normal" or "reference" tax structure for business deductions.

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<sup>1</sup>See Reference [21] Special Analyses G, for a general discussion of tax expenditures. The term "tax subsidy" is used synonymously with "tax expenditure."

<sup>2</sup>Ibid., p. G-6.

<sup>3</sup>Ibid., pp. G-6 and G-7. However, the ACRS does involve tax deferrals, the treatment of which is discussed later on in this section.

<sup>4</sup>Ibid., p. G-2.

Although the Treasury analysts would not include the ACRS as a direct tax subsidy, they recognize that a "capital subsidy" could occur as a result of the tax deferrals resulting from accelerated depreciation allowances:

"...Tax deferrals resulting from special accelerated capital cost recovery allowances are a form of Government lending...The deferral of tax, as compared with the tax stream that would have occurred under reference tax rules, is an interest-free loan."<sup>1</sup>

It appears that if we were to follow the procedures of the OMB analysts, only the ITC would be regarded as a tax subsidy. However, we have taken the more conservative (higher Government cost) position that the ACRS is not in the "normal" structure and/or involves a capital subsidy. Our procedure is to determine the difference between the tax deductions that would occur under the ACRS and those which would occur if the "economic depreciation" on the asset were allowed. We estimate the economic depreciation using a straight-line depreciation method and have assumed in this analyses that the economic life-time of the ship is equal to the length of the lease (25-years).<sup>2</sup> As we understand the OMB method, we believe that our estimates of Government cost would be higher than under their procedures.

### 3. The Discount Rate Under Method II

The question now arises as to the proper discount rate to use under this method. Two characteristics of the rate are definite:

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<sup>1</sup>Ibid., p. G-11.

<sup>2</sup>Here the residual value of the ship at the end of the 25 years is assumed to be zero.

- (1) It should be a rate unadjusted for tax reflows, and
- (2) It should be a "nominal" (before inflation-adjustments) rate.

The latter is necessary because all values in the lease transaction are in then-year dollars.

As we pointed out earlier, the lease versus purchase decision involves an alternative financing decision. It is taken as "given" that the ships will be built; therefore, the issue is not whether resources will be used for public purposes or private purposes. The OMB Circular A-94 discount rate is designed for the latter type of decisions. What is needed in the lease/purchase decision is a discount rate which relates to acquisition financing.

We shall not enter into a theoretical discussion of this issue in this paper; rather, for the convenience of the reader we shall repeat here the three bases that have been suggested:

- (1) The current Treasury bond rate for securities of equal maturity to the lease period. Therefore a 25-year Treasury bond rate would be used for a 25-year lease.
- (2) A weighted average of Treasury security yields where the weighting scheme corresponds to the amortization schedule in the leasing contract.
- (3) An average yield on marketable Treasury obligations with remaining maturities comparable to the period of analyses.

In actual practice, it is not likely that there would be enough difference in the rates determined by these methods to

affect the lease versus purchase decision. Much would depend on the shape of the Treasury security yield curve.<sup>1</sup>

A point that should not be overlooked is that the mortgage interest rate will vary with the Treasury bond rate, and the lease payment is sensitive to this rate as well as the percent mortgaged. Therefore, there must be a link between the mortgage rate and any discount rate which is linked to the Treasury bond rate. This will be demonstrated in the following analyses.

Table 4-8 and Figure 4-3 present discounted Government lease costs using Method II. Here we have used current (June 1983) financial market and tax law conditions for computing the lease payments and have varied the "spread" between the mortgage rate and the Treasury bond rate. Again, the discounted purchase cost is \$100 million for the reasons stated in Section [B.2] of this chapter.

Notice first that the discounted Government cost of leasing is less than the discounted purchase cost (\$100 million) whenever the percent mortgaged is at least 70 percent or higher (the equity percent is 30 percent or lower).<sup>2</sup>

Next, notice in Figure 4-3 that the breakeven point as to the lease/purchase decision varies according to the mortgage percent and the spread between the mortgage rate and the Treasury bond rate. Historically, the spread between the AAA-rated corporate bonds and long-term Treasury bonds has varied

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<sup>1</sup>Currently the yield curve is relatively flat. The average yield is about 11 percent.

<sup>2</sup>Recall that in the nine-tanker procurement the debt/equity ratio was 75/25.



Table 4-8. DISCOUNTED TOTAL GOVERNMENT COST OF LEASING  
A \$100 MILLION SHIP, BY PERCENT MORTGAGED AND  
TREASURY BOND RATE--METHOD II  
12 PERCENT MORTGAGE RATE<sup>1</sup>  
(Dollar Figures in Millions)

Percent Mortgaged	Annual Lease Payment	Treasury Bond Rate			
		12%	11.5%	11%	10.5%
50	9.5	105.9	108.4	111.1	113.9
60	8.6	98.6	100.9	103.3	105.8
70	7.7	91.3	93.3	95.5	97.8
80	6.8	84.0	85.8	87.6	89.6

<sup>1</sup>See Table 3-1 for other values used in calculating the lease payment.

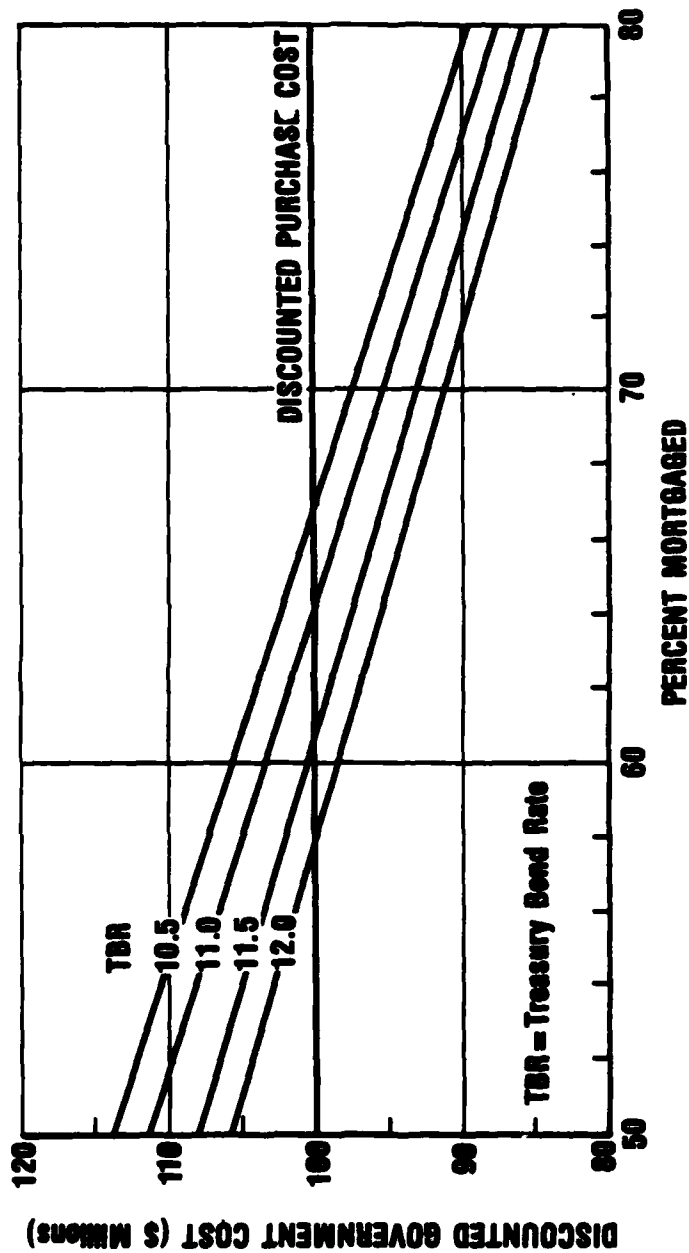


Figure 4-3. DISCOUNTED TOTAL GOVERNMENT COST OF LEASING A \$100 SHIP, BY PERCENT MORTGAGED AND TREASURY BOND RATE

(Mortgage Rate = 12 Percent)

considerably but seldom has been greater than  $1\frac{1}{2}$  percent.<sup>1</sup> Using the latter maximum, the breakeven point on the 10.5 percent Treasury bond rate line would be about 67 percent mortgaged (see Figure 4-3). Actual current market conditions place the Treasury bond rate at about 11 percent, which would provide a breakeven mortgage percent of about 64 percent.

It is our opinion that when the Navy, in effect, guarantees the lease payments the quality of the mortgage bonds involved in the leverage lease arrangement is virtually the same as a Treasury bond with the same maturity. Therefore, there would be no interest rate differential due to the relative risk. However, there would be a difference due to state and local government tax exemption associated with Treasury bonds. We estimate that the effect of these exemptions would not exceed .5 percentage points. This implies that if the mortgage rate is 12 percent, as assumed in Table 4-8 and Figure 4-3, the Treasury bond rate would be no less than 11.5 percent. The relative cost of leasing versus purchasing under this condition is almost equivalent at a debt equity ratio of 60/40.

In any case, it can be concluded that there are practical financial market conditions which would yield discounted total Government lease costs that would be lower than the purchase costs, provided that the debt/equity ratio exceeded about 65/35.

#### **E. CONCLUSIONS: METHOD I VERSUS METHOD II**

When using Method I, the decision as to whether the Government cost of leasing a ship is greater than the cost of

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<sup>1</sup>Reference [18], Tables B-67 and B-86.

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structure," there is not much room for controversy as to assumptions with respect to the calculation of the ITC and accelerated depreciation effects.

Irrespective of the method used, the sensitivity analyses presented in the foregoing sections (see especially Tables 4-5 and 4-8) bring out the fact that there are, indeed, situations when the Government cost of leasing would be less than the Government cost of purchasing or when the cost of leasing is only slightly higher than purchasing. This implies that there may be occasions when considerations other than costs would be the primary factors in the lease/purchase decision.

The analyses also bring out the important point that the debt/equity ratio in the lease agreement is a key factor in determining the lease cost. The greater the percent mortgaged, the lower the lease cost. An agency which intends to enter into a lease contract should be aware of this fact and consider it in its negotiations with the objective of mitigating lease costs to both the agency and the Government. In addition, if leveraged leasing is approved as an acceptable method for acquiring Navy ships or other Government property, agencies seeking to lease should seek approval for waving the IRS provisions that restrict the amount of tax benefits that can be passed on to the agency in the form of lower lease payments.

## **Chapter V**

### **OTHER RELEVANT ISSUES**

In the previous chapters we have examined factors to be considered in a simple financial analysis of the build-and-lease versus purchase decision. In this chapter we examine factors that impact on the economic and political analysis of the decision to lease ships. Specifically, the following issues are addressed:

- What are the Navy's funding options, and what are the implications of each of those options for Navy and Government budgetary processes?
- What are the important contingent costs associated with leasing? How do these costs influence the lease-buy decision, and what are their implications with respect to the future of leasing as an alternative?
- How do IRS regulations influence the Navy's perspective on ship leasing? What changes in IRS procedures might be advantageous to ship leasing?
- Are there general economic impacts associated with leasing that either reinforce or detract from the financial desirability of leasing?

#### **A. FUNDING ALTERNATIVES**

The Navy presently has two sources of funds for ship acquisition:

- Ship Construction and Conversion (SCN) appropriations--for direct purchase of new or converted ships; and
- Operation and Maintenance (O&M) appropriations--for leasing (chartering) new or converted ships--handled through the Military Sealift Command (MSC), which is an activity supported by the Navy Industrial Fund (NIF).

There are significant differences in the way these two accounts are treated by the Congress and the Navy; hence, they cannot be regarded as easily interchangeable alternatives for funding the acquisition of ships. The following discussion highlights some of the issues to be considered when choosing between these two funding options.

#### 1. Trends in Navy Obligations

Table 5-1 presents actual obligations incurred in the relevant Navy accounts since 1970. Figure 5-1 shows the relative growth of the four main accounts. Notice that the Navy's O&M obligations have grown continuously since 1973, as have the NIF obligations. The SCN obligations have fluctuated from year to year, but the secular trend has been about the same as that of the NIF obligations. The sharp increase in (estimated) SCN obligations in 1983 is due primarily to the acquisition of two nuclear carriers in 1983. The Military Sealift Command obligations had a downward or horizontal trend from 1970 through 1976, but have grown rapidly since 1976. This reflects the general revival of sealift requirements and the introduction of prepositioned supply programs.

Table 5-2 and Figure 5-2 show the changes in the relationships between the accounts. Notice first that the MSC declined in relative size from 23.7 percent of the NIF in 1970 to 12.3 percent in 1977; thereafter, it increased to an estimated 16.2 percent in 1983. As a percent of total O&M, however, MSC obligations had a different pattern. After a decline from 19.3 percent in 1970 to 8.1 percent in 1976, the ratio has since fluctuated within a range of 7.1 to 8.1 percent.

Although the NIF and SCN obligations have grown substantially, the growth rate of O&M obligations has been

Table 5-1. ACTUAL OBLIGATIONS INCURRED FOR NAVY OPERATION AND MAINTENANCE  
SHIP CONSTRUCTION, AND INDUSTRIAL FUND, 1970-1983<sup>1</sup> (MILLIONS OF  
THEN-YEAR DOLLARS)

Navy Program or Activity	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982 (Est.)	1983 (Est.)
Operation and Maintenance	5,670	5,413	5,998	6,002	7,204	8,107	9,222	10,714	12,230	14,688	17,831	21,098	22,806	26,023
Ship Construction	2,476	2,380	3,103	2,994	3,820	4,694	3,987	5,718	5,787	5,079	6,464	7,617	8,641	18,650
Industrial Fund (NIF):														
Printing	57	58	63	63	72	86	87	88	95	108	129	151	153	158
Ordnance	535	511	550	670	635	610	636	694	709	759	867	1,025	1,153	1,211
Shipyards	1,302	1,248	1,229	1,182	1,221	1,405	1,583	1,780	1,986	2,179	2,482	2,874	3,044	3,730
Military Sealift Command	1,097	875	863	764	731	849	747	784	918	1,026	1,377	1,711	1,837	2,056
Research	905	945	1,176	1,354	1,414	1,587	1,620	1,809	1,900	2,004	2,332	2,656	2,897	3,094
Base Services	157	171	199	216	241	314	347	413	467	533	624	747	859	887
Aircraft Maintenance Facilities	585	573	607	607	578	630	714	789	932	980	1,043	1,258	1,356	1,544
Total NIF	4,637	4,381	4,687	4,856	4,892	5,480	5,734	6,357	7,007	7,588	8,854	10,852	11,673	12,680
Unobligated NIF Balance, End of Year	661	718	754	798	760	629	785	1,100	1,429	1,900	1,938	2,027	1,557	770

<sup>1</sup>Transition Quarter has been omitted.

Source: Budget of the United States Government: Appendices, 1972-1983.



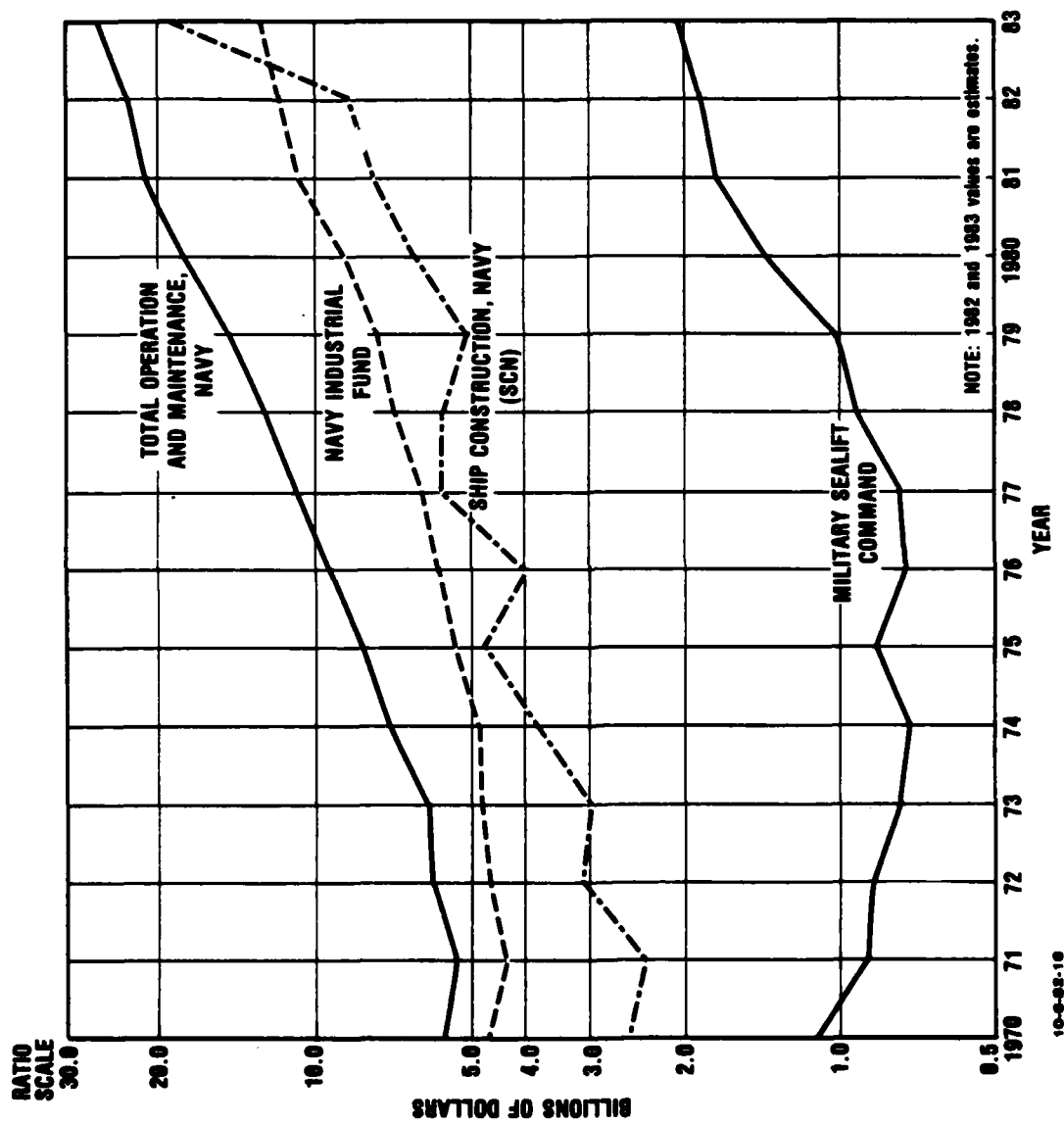


Figure 5-1. ACTUAL OBLIGATIONS INCURRED FOR NAVY O&M, SCN, INDUSTRIAL FUND, AND MILITARY SEALIFT COMMAND

Table 5-2. SELECTED OBLIGATIONS RATIOS, 1970-1983  
PERCENT

Year	MSC/NIF	MSC/O&M	NIF/O&M	SCN/O&M
1970	23.7	19.3	81.8	43.7
1971	20.0	16.2	80.9	44.0
1972	18.4	14.4	78.1	51.7
1973	15.7	12.7	80.9	49.9
1974	14.9	10.1	67.9	53.0
1975	15.5	10.5	67.6	57.9
1976	13.0	8.1	62.2	43.2
1977	12.3	7.3	59.3	53.4
1978	13.1	7.5	57.3	47.3
1979	13.5	7.0	51.7	34.6
1980	15.6	7.7	49.7	36.3
1981	15.8	8.1	51.4	36.1
1982	15.7	8.1	51.2	37.9
1983	16.2	7.9	48.7	71.7

Source: Derived from Table 6-1.

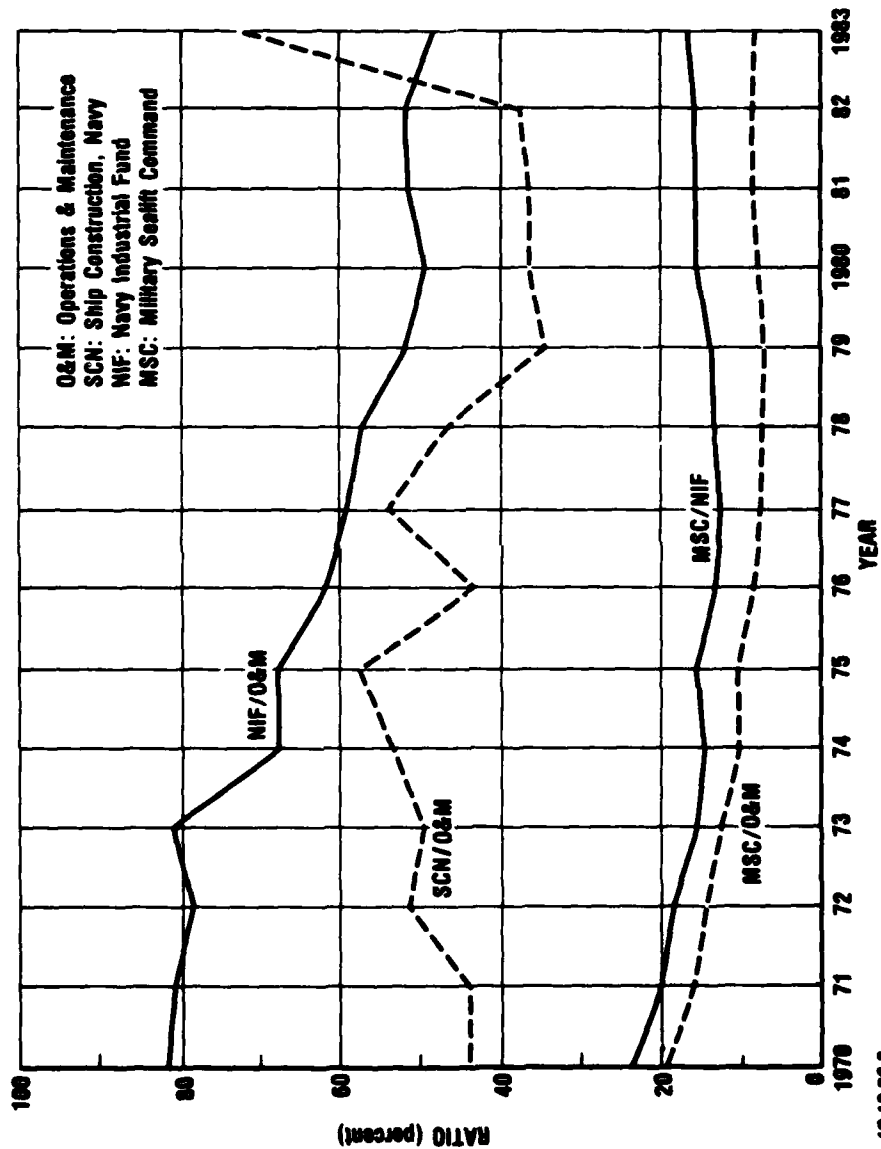


Figure 5-2. SELECTED OBLIGATIONS RATIOS, FISCAL YEARS 1970-1983  
 NOTE: 1982 and 1983 are estimates.

generally higher. This can be seen in the last two columns of Table 5-2. NIF as a percent of total O&M declined from 81.8 percent in 1970 to 51.7 percent in 1979 and has averaged about 50 percent since that time. SCN as a percent of total O&M has fluctuated from year to year, but the lowest values have occurred in recent years. Whether or not the large increase in 1983 indicates that the SCN/O&M ratio will continue to be larger in future years cannot be determined at this time; however, one can expect that an increase in the size of the fleet will cause an increase in O&M requirements, regardless of the change in other categories of obligations.

## 2. Funding Processes

### a. Ship Purchases

The authority to obligate funds for the purchase of new or converted ships must come directly from Congress through the control of the SCN account. Congressional Committees perform full reviews of each and every Navy ship acquisition proposal, and when the funds are approved there is a clear understanding between Congress and the Navy that the program will be carried out within reasonable limits as proposed by the Navy and at the proposed cost. If the full amount of the obligation authority is approved, the Navy can proceed to let all of the contracts. When the ships are delivered, final payments are made to the shipbuilders and the Navy has no further payment obligations except for claims that may be filed by shipbuilders for contract cost increases arising from scope changes.

### b. Leases

Currently, if the Navy were to decide to enter into a leasing program, it could do so without seeking approval

through a formal Congressional appropriation process.<sup>1</sup> Lease payments are made out of O&M funds which are not generally appropriated on a line-item basis. Within limitations, therefore, the Navy is free to reprogram O&M funds as it determines to be appropriate. Advanced contract obligations associated with a lease are another matter and will be discussed later.

As indicated in the following tabulation, the 13-ship TAKX leasing costs will increase the annual MSC obligations by about 10.6 percent over the 1983 estimated value.

Program	Annual Lease Cost (\$Millions)*	Percent of 1983 Obligations for		
		MSC	NIF	O&M
13-TAKX	217.9 <sup>a</sup>	10.6	1.7	0.8

\*Estimated using the IDALEASE program and the Navy Study assumptions.

This does not include the additional ship operating and maintenance costs, which have been estimated at about \$230 million;<sup>2</sup> however, the latter costs would be essentially the same per year regardless of whether the ships were purchased, leased, or hired under a time-charter. The primary significance of the lease costs is that they are long-term commitments that cannot be abrogated without significant termination costs. In other words, lease payments represent increases in the MSC fixed costs that must ultimately be covered by O&M appropriations. By itself, the TAKX program

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<sup>1</sup>Current practice, however, is to obtain approval from the cognizant Congressional Committees.

<sup>2</sup>Reference [7], p. 8.

would account for less than one percent of total O&M obligations for 1983; however, if additional programs were to be approved, major adjustments in MSC, NIF and O&M funding would be required.<sup>1</sup>

The most important funding constraint on the lease alternative is the fact that currently there is no special appropriation or contract authority to cover the advance contract obligations required by build and charter programs. Under a time-charter program the Navy typically must sign a five year lease commitment for each ship, and the lease payments may start several years after the contract award date. SCN funds cannot be used for this purpose unless the Navy is willing to give up other programs. O&M funds cannot be used for this purpose, because they are appropriated on an annual basis.<sup>2</sup> Technically, the Navy may use the unobligated balance of customer orders provided to the Navy Industrial Fund and has proposed to use this as a source of funds for the TAKX program obligations. However, the availability and timing of the NIF unobligated balance is difficult to predict and funds may not be adequate to cover the entire program. Thus, an adequate mechanism for handling the advance commitments for large scale leasing activities is currently not available to the Navy.

It is important to note that under current budget review procedures Congress would normally not directly consider

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<sup>1</sup>It has been estimated that 80-85 percent of the O&M budget is fixed cost; so that the addition of one percent fixed cost translates to roughly a five percent decrease in the discretionary areas of O&M (Reference [8]). In other words, Congress would undoubtedly have to appropriate additional O&M funds to cover the leasing programs on a permanent basis.

<sup>2</sup>The individual lease payments are appropriated on an annual basis, but an advance commitment cannot be made out of anticipated O&M appropriations.

purchase and leasing as alternatives for financing the acquisition of a ship. The O&M and SCN budget review processes are separate entities. Moreover, because the leasing option has not been strongly advocated by the Navy or other Services in the past, the option has not been given the thorough review it would have received if it had been subjected to frequent scrutiny in previous years. For large programs such as the TAKX or other major systems acquisitions, the purchase and lease options and their impacts on their respective funding mechanisms need to be considered and suitable mechanisms (e.g. contract authority) for handling large leasing commitments need to be developed. These considerations become especially important when one considers the contingent costs associated with leasing.

#### B. CONTINGENT COSTS

There are, in addition to the direct lease costs, contingent costs that under certain conditions could necessitate substantial outlays by the Navy. The two most important contingent costs are:

- Termination costs--costs incurred because either the Navy does not exercise the option to renew the charter for the next five-year period or terminates the charter for convenience; and
- Tax indemnity costs--compensation payments for tax losses suffered by the equity owner because either the IRS disallows the tax benefits assumed in computing the time charter payment or the Navy changes the capitalized cost basis through ship modifications subsequent to the beginning of the charter period.

1. Termination Costs

a. Percentage Values

Table 5-3 and Figure 5-3 present estimates of the lease termination liabilities for the Navy under the 13-ship TAKX program. These estimates were derived from figures provided by one of the bidders and may not be applicable to all of the ships. The termination costs, which are calculated by applying the cost ratios to the unadjusted capitalized cost of the ship, represent the basic termination cost. The Navy has several options that could reduce the effective cost of termination, including a requirement that the ships be sold and the net proceeds from the sale be deducted from the basic termination charge.

If the Navy terminates the contract during the construction period, it must pay the relevant accumulated costs arising from the construction contract. After the lease commences, the termination values are based upon the following components:

- Unrecovered equity investment;
- Principal balance of the loan(s); and
- Tax effects resulting from the termination.

Table 5-3 indicates that the highest termination values occur during the first five years when the tax effects would be the greatest.<sup>1</sup> The termination percentage reaches 100--the capitalized value of the ship--after about 15 years (1999).

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<sup>1</sup>Under the TAKX charter agreement, the Navy has agreed not to terminate for convenience during the first five years. See Reference [6], Attachment I, Article 5(c).



Table 5-3. ESTIMATED LEASE TERMINATION LIABILITY FOR  
NAVY AND GOVERNMENT--THIRTEEN TAKX PROCUREMENT  
(PURCHASE COST = \$2,392 MILLION)

Event	Year	Percent of Capitalized Cost <sup>a</sup>		Termination Liability (\$ Millions)	
		Navy	Government	Navy	Government
Begin Construction	1983	21.9	21.9	524	524
	1984	87.7	87.7	2,098	2,098
Begin Lease	1985	125.5	109.4	3,002	2,617
	1986	132.9	95.9	3,179	2,294
	1987	135.3	83.8	3,237	2,005
	1988	133.3	74.1	3,189	1,713
	1989	128.1	67.4	3,064	1,612
First Renewal	1990	122.1	64.6	2,921	1,545
	1991	120.5	63.5	2,882	1,519
	1992	118.8	62.3	2,842	1,490
	1993	116.7	61.1	2,792	1,462
	1994	114.8	59.8	2,746	1,430
Second Renewal	1995	112.6	58.4	2,694	1,397
	1996	110.1	57.0	2,634	1,363
	1997	107.5	55.6	2,572	1,330
	1998	102.4	52.6	2,450	1,258
	1999	96.8	49.5	2,316	1,184
Third Renewal	2000	91.0	46.5	2,177	1,112
	2001	84.8	43.2	2,028	1,033
	2002	78.1	39.7	1,868	950
	2003	70.9	36.0	1,696	861
Fourth Renewal	2004	63.3	32.0	1,514	765
	2005	55.0	27.8	1,316	665
	2006	46.2	23.2	1,105	555
	2007	36.8	18.4	880	440
	2008	27.0	13.4	646	321
	2009	17.0	8.3	407	198

<sup>a</sup>Derived from figures provided by one of the bidders. May not apply to all 13 ships.

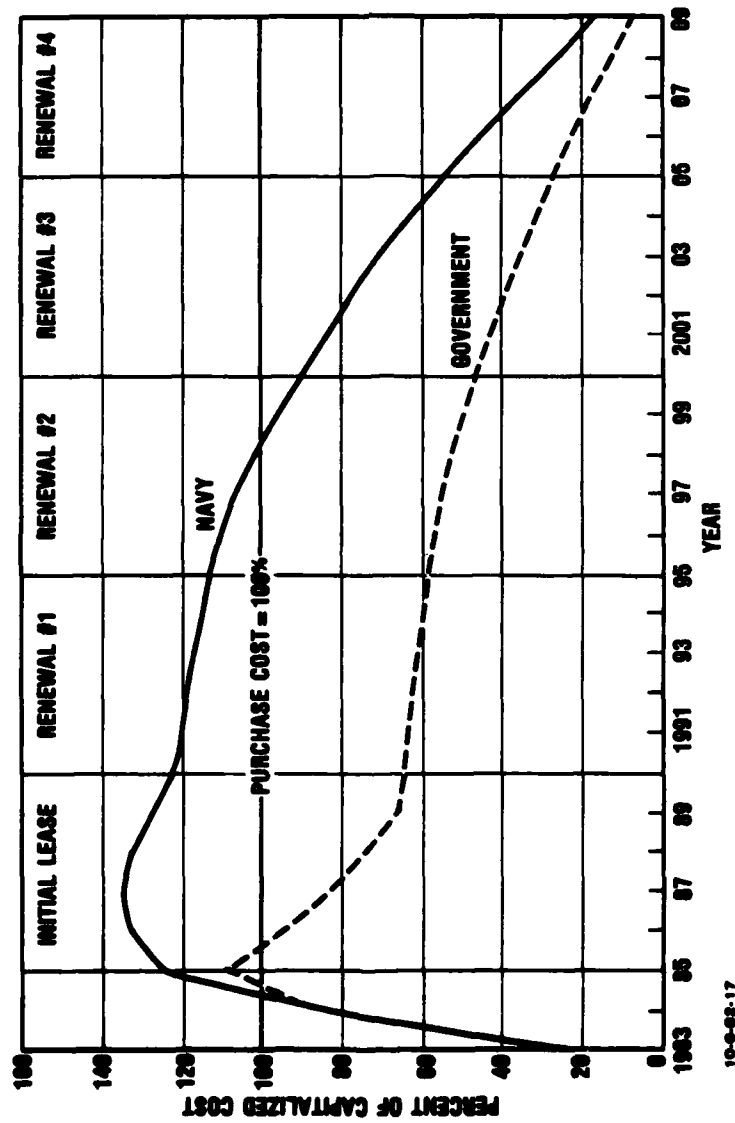


Figure 5-3. NAVY AND GOVERNMENT LEASE TERMINATION LIABILITY AS A PERCENT OF CAPITALIZED COST

#### **b. Termination Options<sup>1</sup>**

If the Navy decides to terminate the time charter at the end of a five-year lease period or for convenience during a lease period, several options are possible:

1. The Navy may pay the termination value - termination percentage times the basic capitalized cost - less the net proceeds of the sale of the ship(s);
2. The operating company may elect to waive the payment of termination value and retain the ship(s);
3. The Navy may purchase the ship(s) at the then current fair market value or the termination value, whichever is higher; or
4. The Navy may withdraw its notice of termination and continue to lease the ship(s). This could occur if the ship(s) cannot be sold at what the Navy believes to be reasonable and fair market value.

#### **c. Termination Liability**

If the Navy decides to terminate the charter at the end of a lease period, or for convenience during any lease period, it must pay the basic termination cost. If the ships have any realizable market value, the basic termination cost may be reduced by the net proceeds of the sale; otherwise, the full basic termination cost must be paid. Thus, the conservative estimate of the contingent liability of the Navy would be the unadjusted basic termination costs.

Table 5-3 shows the total contingent liability for the 13-ship TAKX program. These figures were obtained by multiplying the estimated capitalized cost of the 13 ships (\$2,392 million) by the termination value percentages. Remember, these percentages were derived from the submission

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<sup>1</sup>Reference [6], Attachment I, Article 5.

of one bidder and may not apply to all ships. The intent here is only to provide a general measure of the magnitude of the termination liabilities associated with this type of program.

## 2. Tax Indemnity Costs

Two elements of uncertainty about tax treatment of a contract arise when attempting to develop a lease (charter) contract with the Navy:

- How will the IRS rule with respect to the tax attributes of the transaction? In a government transaction this includes whether the contract is a true lease or a service contract.
- Will Congress change the tax laws so that the ITC and/or the ACRS factors are modified?

Because it is possible that the IRS could adversely characterize the contract or that Congress could change the tax law, a tax contingency clause is placed in the charter contract that provides for compensation to the lessors (equity owners) in the event of losses resulting from such changes.<sup>1</sup> The actual method of compensation has important implications for Navy budgetary procedures. Under the TAKX contract, the adjustment is made by a direct payment to the equity owners for those losses incurred in each tax year effected.<sup>2</sup> The compensation is not paid through an adjustment of the remaining lease payments. Thus, a major change in the tax

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<sup>1</sup>See Reference [6], Attachment I, Article 40. In the private sector, a tax contingency clause is standard procedure in most leveraged leases.

<sup>2</sup>Ibid., Article 40, Section (c).

laws could result in a large, immediate Navy liability to the equity owners.<sup>1</sup>

### 3. Sources of Funds

An important question arises: Where will the Navy obtain the funds to cover the costs incurred should either one or both of the contingent events occur? If the Navy decided to terminate the leases early in the program, the termination costs could exceed the original purchase costs. These costs could effectively wipe out the unobligated balance in the NIF.<sup>2</sup> Funds would have to be obtained at the expense of other programs and/or through additional Congressional appropriations. However, there is no guarantee that Congress would or could approve the funds at the time they are needed; thus reprogramming is the more likely solution. Of course, the Navy always has the option of continuing to lease the ships and place them in the Reserve Fleet. This, however, could be a costly solution, particularly if the ships are not actually needed or in use for an extended period of time.<sup>3</sup>

Thus, the existence of contingent costs adds an important element to the purchase versus lease decision. From the relative cost standpoint, it would appear that the leasing option should not be considered unless there is a high probability that the Navy will lease (use) the ships throughout the entire period of the lease, or unless there is

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<sup>1</sup>Payment must be made within 20 days of receipt of the approved documentation of the tax loss.

<sup>2</sup>As indicated earlier, the Navy has proposed use of the unobligated balance as a funding alternative.

<sup>3</sup>Ship rotation procedures, however, might reduce the overall costs.

a high probability of a resale value for the ships that would substantially reduce the termination costs. The latter situation could occur if there were an easily perceived, profitable use for the ship by the private sector. The former condition could be met if there were a long-term need for that type of ship in the fleet.

Restating the above two conditions in terms of the characteristics of ships, the lease alternative should not be considered unless:

1. The ship is designed to be readily adaptable to commercial uses. This enhances the leasability or saleability to commercial interests and reduces likely termination costs; or
2. There is a high probability of a continuing need for the ship. This would reduce the likelihood that the Navy would need to terminate the lease.

Under these decision rules the TAKX would be a good candidate if (1) the prepositioning requirement continues, or (2) the Navy would continue to have a contingent mobilization need for the ships whereby they would be placed in the reserve fleet, or (3) the ships are designed to be adaptable to commercial uses. Standard auxiliary ships used in the fleet would also be good candidates because the expectation for their continued use is very high.

#### C. IRS REGULATIONS

Current IRS regulations can, in effect, dictate the way ships leased by the Navy will be operated by penalizing leasing contracts which involve direct operation by Navy personnel. In order to minimize lease payments through tax benefit (e.g. ITC) "pass-throughs," the Navy must enter into a time-charter arrangement which involves day-to-day operation

by civilian crews. Under some conditions this can be a distinct military disadvantage.

In addition, there is a degree of uncertainty associated with build-and-lease time-charter contracts with the Navy as to whether the IRS will rule that the equity owners will be allowed the Investment Tax Credit and full Accelerated Cost Recovery System deductions. As a result, tax indemnification clauses have to be included in the contract to cover these contingencies.<sup>1</sup>

If Congress, DoD, and the Navy generally agree that leasing is a reasonable financing alternative for large scale ship acquisition programs, it might be desirable to pass legislation that would clarify the tax status of time-charter contracts with the Navy. Moreover, it might be desirable to permit the Navy to be allowed to enter into bareboat leases where the lessor is permitted to take the Investment Tax Credit. The latter provision would eliminate the lease cost penalty of operating leased ships with Navy personnel.

Full utilization of the potential for savings generated by leveraged leasing would require an exemption from Revenue Procedure 75-21 for those leasing to agencies of the Federal Government. Congressional approval of such an exemption would allow the agency leasing and the Treasury to reap the full benefits of the tax-shield pass through possible with leasing.

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<sup>1</sup>Such clauses are standard in commercial leases. The point here is that they must also be included in Navy contracts. This increases contingent costs associated with the contract and exacerbates the funding problem if the contingency occurs.

#### D. ECONOMIC IMPACTS<sup>1</sup>

There is no question that shipbuilding--particularly the building of commercial-type ships--would provide a stimulus to economic recovery for the following reasons:

1. A useful product is generated. Shipbuilding is not a "make work" activity.
2. Capacity already exists. Immediate response to orders can be expected.
3. A basic complement of trained workers is available. Supportive semiskilled and unskilled workers can be obtained from the ranks of the unemployed without major training requirements.
4. Shipbuilding is labor intensive. Labor accounts for 60-75 percent of the cost of a ship.
5. Many industries are affected:
  - Shipbuilding (primarily assembly of the ships);
  - Steel and other metal fabrication;
  - Machinery (propulsion systems);
  - Heating, air-conditioning, electrical machinery and components; and
  - Electronics.
6. Shipbuilding would affect economic activity in many regions of the country:
  - Coastal areas for shipbuilding; and
  - Other areas for machinery and materials.

Consequently, a high labor multiplier effect can be expected for the shipbuilding activity. This makes shipbuilding an excellent candidate for any national economic stimulus program. The fact that there is an estimated need for naval ships adds to the acceptability of such programs.

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<sup>1</sup>Reference [11] contains a thorough analysis of the shipbuilding industry and its relationship to other industries.



Fundamentally, the economic impact issue is of no particular significance in a simple direct purchase versus lease decision; the ships would be constructed in either case, and the same economic impacts would result. The issue does become important, however, if leasing would accelerate acquisition of the ships and the shipbuilding industry and/or the economy needs to be stimulated.

It is important to note also that there would be no immediate government expenditures under the accelerated leasing program. Lease payments would begin several years after initiation of the program. The private sector would finance the construction of the ships. In contrast, if the Navy purchased the ships, the Government would have to finance the accelerated or phased ship construction out of current funds and perhaps increase its current budget deficit. Out-year budget deficits, however, would be affected by the lease payments.

It can be argued, of course, that the accelerated lease program would only divert private sector investment from other activities to the shipbuilding activity; therefore, no net gain in economic activity would result. There is also the possibility, however, that the "visibility" of the shipbuilding activity could help stimulate new investment so that the net effect would be positive. It is most likely, however, that in a time of reduced (depressed) economic activity, a clear Government signal to invest in shipbuilding would provide a net positive stimulus to the economy.

The foregoing discussion boils down to the question: which is more important, economic stimulation now, or an increase in Government spending from 3 to 25 years in the future? This, of course, is the issue that must be faced with every discretionary Government program. Assuming that there

is a need for the ships, the key point that leasing has in its favor at this time is that the ships could be built--and the economic stimulus would occur--without immediate pressure on Government expenditures. The out-year expenditures, however, will be affected, and limiting Government expenditures in future years will be more difficult.

The accelerated procurement option is the only option embodying a potential for achieving an economic stimulus that would not otherwise occur. Economic stimulus is not a factor in the direct purchase versus lease option. Here both options yield the same economic impacts; therefore the key issues would involve only the relative direct costs, contingent costs and funding mechanisms. Nevertheless, it should be recognized that naval shipbuilding is an excellent activity for stimulating economic recovery while at the same time acquiring a needed defense capability.

#### **E. APPLICABILITY OF LEASING TO OTHER MILITARY SYSTEMS**

From the standpoint of financing alternatives, there is no reason why leasing cannot be applied to military systems other than naval auxiliaries. Some military aircraft have longevity and use characteristics which are similar to naval auxiliaries. Certain Army land vehicles may also be good candidates for short-term leasing. However, it is not necessarily the type of military equipment or system that matters, but whether or not the private sector financial community would be willing to enter into the lease transaction at terms favorable to the Government and whether leasing fits into the Government's capital acquisition philosophy.

Throughout this chapter we have tried to point out that there are many factors other than the relative cost of leasing versus purchasing that need to be considered. Under the same

economic conditions and leasing terms, a \$100 million capital acquisition will yield the same lease payment irrespective of whether the asset is a naval warship, naval auxiliary ship, fighter plane, cargo airplane, group of tanks, or any other military system. Moreover, as has been demonstrated in this study, the discounted total Government lease cost might be less than the discounted Government purchase cost so that leasing would be favored on relative cost grounds. But do the other factors make sense? Is the Government willing to accept private sector ownership of military weapons systems? Is the private sector willing to invest in such systems without requiring unacceptable (to the Government) contingent and termination cost premiums? Is Congress willing to accept the long-term funding implications?

These are all issues which need to be examined much more thoroughly. A general Government leasing policy needs to be developed with respect to military systems which clarifies the boundaries and conditions where leasing would be considered as an alternative form of financing.

## Chapter VI

### CONCLUSIONS AND RECOMMENDATIONS

#### A. CONCLUSIONS

##### 1. Lease Versus Purchase Costs

The foregoing analyses indicate that lease versus purchase costs should be examined from two viewpoints: the Navy as the agency acquiring the ship, and the Government as the source of funds for financing the ship.

##### a. The Navy's Viewpoint

- (1) For the Navy, the key issue in the lease versus purchase trade-off is: which appropriation accounts should be used for the acquisition of the ship. Because financing costs and net tax effects are not accounted for in these appropriation accounts, the Navy should not include such costs in its lease/purchase cost analysis; i.e., only the direct and contingent costs of leasing or purchasing which would have an effect on the Navy's budget expenditures should be considered. The lease payment stream should be adjusted for inflation but should not be discounted to account for finance costs. Except when the expected inflation rate is high (greater than five percent), the inflation-adjusted direct cost (exclusive of financing costs, tax effects and contingent costs) of leasing a ship will exceed the direct cost of purchasing the ships. Therefore, the Navy's lease versus purchase decision normally reduces to one of deciding whether paying the higher lease costs out of Operation and Maintenance appropriations over a long period of time is worth the savings it would obtain for the Ship Construction and Conversion (SCN) appropriations.

- (2) Contingent costs should be an important element in the Navy's lease cost analyses because lease agreements typically include termination and tax indemnification clauses. The TAKX termination provisions, for example, require the Navy to pay termination costs which would exceed the purchase price at least through the second five-year option. Uncertainties with respect to the IRS characterization of the TAKX contract also increase the potential for higher future lease costs. The Navy, therefore, should be reasonably certain that premature termination would be unlikely and should attempt (as it has in the past) to obtain firm rulings from IRS regarding the contract. The application of leasing arrangements to standard auxiliary ships that would have continuous use in the Navy over their lifetimes would reduce the probability of termination.
- (3) In order to minimize the direct cost of leasing (lease payments), the Navy should design the contracts to take advantage of all factors which affect the lease costs. This includes the debt/equity ratios and mortgage rates, in addition to tax benefits.

**b. The Government's Viewpoint**

- (1) The lease/purchase issue involves a decision regarding alternative forms of financing. Therefore, the OMB Circular A-94 directive is not applicable with respect to the basis of the discount rate to be used in the Government cost analyses. A discount rate based upon yields on Treasury securities should be used.
- (2) Costing Method I properly accounts for all leasing costs including direct costs, Treasury revenue losses and Treasury revenue gains. However, the method is highly sensitive to assumptions regarding the mortgage holders tax rates. Minor differences in these assumptions could lead to completely opposite conclusions as to whether to lease or purchase.
- (3) Costing Method II has the advantage of being insensitive to mortgage holders' tax rate assumptions.

- (4) Both methods demonstrate that there are, indeed, financial market and/or contractual conditions when the discounted total Government cost of leasing may be lower than the Government cost of purchasing and financing the ship or when the cost differences are small enough to neutralize relative costs as a factor in the decision.

## 2. Funding

- a. The issue of whether to lease or purchase ships incorporates a decision as to whether O&M or SCN funds are to be used.
- (1) Leasing currently requires a long-term commitment of O&M funds and the unobligated balances of the Navy Industrial Fund (NIF).
  - (2) There may be Congressional concern over increasing the fixed-cost proportion of O&M funds and the use of the NIF for substantial lease obligations.
  - (3) Contingent costs, if incurred, could cause a substantial disruption of procurement programs in the future.
- b. Although Congress was kept informed during the TAKX procurement, Congressional review of leasing programs proposed by the Navy is not normally performed concurrent with the review of direct purchase (SCN) programs. Therefore, leasing and purchasing are not considered directly as financing alternatives.
- c. The Navy has viewed leasing as a way to conserve SCN funds for procurement of combat ships. Because it has the legal authority to commit unobligated NIF balances, the Navy can enter into lease procurement activities before obtaining Congressional approval. If leasing is applied extensively to ships, this could be a matter of considerable concern.
- d. Because O&M appropriations are made on an annual basis, they are subject to the normal exigencies of the Government budget-making and approval process and possibly severe cut-backs. Long-term leasing programs add to the fixed cost portion of O&M funds; therefore, the discretionary portion of the funds

may be reduced. A sharp reduction in O&M appropriations could force a significant re-programming of O&M funds and affect the Navy's overall operating position.

### 3. IRS Regulation

- a. Under current IRS regulations, the lease cost to the Navy is substantially higher if it operates the leased ship under a bareboat charter. This constrains the use of Navy personnel for the day-to-day operation and maintenance of the ship.
- b. Uncertainty about future tax provisions and how the IRS will rule on a leasing contract with the Navy adds to the contingent costs through the tax indemnification provisions of the contract. This, in turn, adds to the uncertainty of how future O&M funds may be committed.
- c. Restrictions of the size of the lease payment imposed by IRS regulations limits the benefits the leasing agency and the Treasury can derive from leasing. Currently, at high interest rates the debt/equity ratio required by the regulations does not permit full exploitation of benefits associated with leasing.

### 4. Economic Impacts

- a. In general, any shipbuilding program would assist economic recovery. Such programs are especially attractive because they:
  - (1) Produce a needed and useful product;
  - (2) Are labor intensive; and
  - (3) Affect many industries.
- b. The economic impacts of leasing and purchasing are equivalent, unless leasing would accelerate the Navy acquisition program.

## **B. RECOMMENDATIONS**

### **1. Leasing as a Viable Alternative**

The build-and-lease option should be regarded as a feasible financing alternative to the direct purchase and financing of naval auxiliary ships.

From a relative cost standpoint and regardless of the costing method used, the discounted total cost of build-and-lease programs for acquiring naval auxiliary ships could be lower or slightly higher than the cost of direct purchase programs. In addition, there could be occasions--such as an immediate, unforeseen military requirement--when the Navy or Congress would prefer to accelerate ship acquisition without immediate changes in the SCN budget or general Government finances. Leasing makes this possible, but at the price of increasing the long-term, fixed portion of the Navy's O&M obligations.

### **2. Budget Review**

Build-and-lease programs should be reviewed at the same time and at the same level as purchase programs and in advance of any leasing procurement activity.

For some types of ships, the build-and-lease option may be a sensible financial alternative to purchasing. This implies that the Navy's Ship Construction (SCN) program proposals should be examined each year for possible leasing alternatives.

In any case, all cognizant Government agencies and branches should have the opportunity to perform an unrestricted review of build-and-lease programs at the same time that the purchase programs are reviewed. Leasing impacts on future O&M funds; hence, the agencies would be remiss if



they did not perform a thorough review with the options of modifying or, if necessary, vetoing the program.

It should be noted that the Navy has used the build-and-lease option only a few times; hence, there have been limited opportunities for Government-wide consideration. Clearly, if leasing programs become commonplace and/or substantial in terms of total cost, the review of leasing programs needs to be made systematic and thorough.

### 3. Regulations

If the Navy/Government intends to increase the number of build-and-lease programs, consideration should be given to the modification of IRS regulations and/or practices in order to clarify the nature of the leases.

Clearly, the Navy should not tailor its operations simply to obtain tax benefit "pass throughs" from lessors. Currently, however, in order to assure that the equity owners will receive the maximum tax benefits, so they can pass through those benefits to the Navy in the form of reduced lease payments, the Navy must apparently absolve itself of any financial interest in the ships and must not control, operate or maintain the ships on a day-to-day basis. Further, if the Navy were to decide to obtain a direct bareboat lease from the equity owners and operate the ships with Navy personnel, the Investment Tax Credit would not be allowed. Consequently, the tax benefits to the equity owners would be substantially reduced, and the lease cost to the Navy would be substantially higher.

It may be desirable for the Navy to be able to enter into a build-and-bareboat-lease program without a cost penalty. This could be achieved if the equity owners (lessors) of naval ships were allowed to take the Investment Tax Credit and apply

the Accelerated Cost Recovery factors as they would under a private sector leasing arrangement. This would imply a change in IRS regulations to exempt naval ships from the provision that the ITC cannot be taken when a lease is to a Government entity.

In addition, the IRS regulations should be changed to permit the full pass-through of tax benefits by lessors to the Navy. Current restrictions on the "profitability" of a true lease could be modified to permit lease payments to be less than the amount necessary to service the debt secured by the ship.

#### **C. GENERAL COMMENT**

The trade-off between using immediate SCN funds for purchasing auxiliary ships and the long-term commitment of O&M funds that lease financing implies is still an open issue. There are general economic and military advantages to accelerating the ship acquisition program. Leasing could help in accelerating the ship acquisition and would postpone and smooth out the flow of direct Government outlays for ships. In the present environment of concern over growing near term federal deficits, leasing might be an attractive way to finance ship procurement. On the other hand, out-year Government expenditures would increase, and the objective of controlling future deficits would be made that much more difficult.

This study has shown that under reasonable economic criteria, the build-and-lease financing procedure can be considered as a possible alternative to ship procurement. However, overall policy implications of this issue have not been examined thoroughly in this study and should be explored

further by the Department of Defense with the cognizant  
authorities in the Executive and Legislative branches.

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## **GLOSSARY**

### **ACRONYMS**

#### **ACRS**

Accelerated Cost Recovery System. A schedule of depreciation factors (percentages) that may be applied to the allowable capital cost to determine the depreciation deductions for an asset over a set of years.

#### **IRS**

Internal Revenue Service.

#### **ITC**

Investment Tax Credit. Currently ten percent of the allowable capital cost may be deducted from a firm's tax liability.

#### **MPS**

Maritime Prepositioning Ships. Program to provide prepositioned supplies for the support of Marine Amphibious Brigades.

#### **MSC**

Military Sealift Command.

#### **NIF**

Navy Industrial Fund.

#### **O&M**

Operation and Maintenance.

#### **SCN**

Ship Construction and Conversion, Navy. Usually applies to the Navy's construction and conversion plan, budget authorizations or available funds.

#### **TAKX**

A cargo ship (AK). The T indicates that it is to be civilian-manned. The X indicates that the design has not been settled upon.

## DEFINITIONS

### ACQUISITION COST

The acquisition costs incurred by the owners of the asset. These costs become the basis for establishing the capital value of the asset. In a private sector transaction this becomes the basis for calculating the depreciation deductions, the Investment Tax Credit (ITC) and the lease payment.

### BAREBOAT LEASE (CHARTER)

A direct lease (charter) of a ship and its basic equipment with no provisions for its operation. The leasee has full control of the ship and has the full range of options as to how it will be manned and operated.

### CONTINGENT COSTS

Costs which may occur if the original conditions of the lease agreement are changed. For example, if the tax law changes such that the Investment Tax Credit is eliminated, an upward adjustment to the lease cost may be required to compensate the lessor for this new development because his original cost estimate assumed that an Investment Tax Credit would be allowed.

### EQUITY

The fraction of acquisition cost supplied by the ship owners.

### EQUITY OWNER (PARTICIPANT)

One of the owners of the equity in the ship.

### LEVERAGED LEASE

A lease whereby the owners of the ship supply only a fraction (20 to 50 percent) of the acquisition cost and obtain a long-term loan for the remainder. The "leverage" comes from the fact that the owners (equity owners) obtain tax benefits based on the entire acquisition cost, not just the fraction that they contributed (see Chapter II for a broader discussion of this concept).

### TAX SHIELD (SHELTER)

An allowable deduction from gross income in arriving at the taxable income.

### TERMINATION COSTS

Costs which the Navy must pay if it elects to terminate the lease (time-charter) at the end of a specific lease period or for convenience.

#### TIME-CHARTER

Under this arrangement the cargo space in the ship is leased for a specific period of time, but the day-to-day operation and maintenance of the ship is controlled by the owner/operator. Assuming that the Navy leases all of the cargo space, the Navy actually controls the ship's destinations and schedules and sets standards for operation and maintenance. Technically, however, the degree of control by the Navy is less than what it would be under a bareboat lease.

#### UNDISCOUNTED COST

The actual cost of the asset in current dollars. May also be in constant dollars.



Appendix A  
PROJECT TASK ORDER



## DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

1400 WILSON BOULEVARD  
ARLINGTON VIRGINIA 22209

### TASK ORDER FOR WORK TO BE PERFORMED BY THE INSTITUTE FOR DEFENSE ANALYSES

TASK ORDER T-3-158  
NO. MDA903 79 C 0018

23 March 1982

You are hereby requested to undertake the following task:

**TITLE:** Lease Versus Purchase of Naval Auxiliary Ships

1. This task order is for work to be performed by the Institute for Defense Analyses (IDA) for the Under Secretary of Defense for Research and Engineering.

2. BACKGROUND:

Under current and near term constrained budget conditions, the planned and approved buildup of naval surface and submarine forces will require new ship construction financial resources substantially above expected budget authorizations. Funding for high priority combat ships has been accomplished by deferring construction of auxiliary ships.

Since such ships provide support to battle groups and are essential to other Navy missions, achieving the balance of ships for overall fleet effectiveness could be delayed by failure to procure these ships in proper sequence.

3. OBJECTIVE:

To examine the feasibility of leasing Naval Auxiliary ships--as an alternative to purchasing the ships--in the context of projected near- and long-term capital market and federal budget conditions.

4. ADDITIONAL GUIDANCE:

Auxiliary ships include both underway replenishment ships and fleet support ships, including ships under the Military Sealift Command. If feasible, amphibious warships will also be considered.

The study will examine the following areas (and others as appropriate):

- (1) Number and characteristics of support ships most suitable for leasing.
- (2) Projected short- and long-term leasing market conditions including:
  - a. Alternative types of leases
  - b. Parties involved
  - c. Factors influencing lease provisions and pricing including tax provisions, residual values, interest rates, insurance, government regulations).
  - d. Supplier attitudes toward leasing Naval ships.
- (3) Costs of leasing versus purchasing auxiliary ships.
- (4) Capital market and federal budget impacts.
- (5) Alternative funding procedures.

The experience of the Department of Defense and other Federal Government agencies (e.g., MARAD) in leasing similar major capital items shall be reviewed. In addition, private sector companies involved in ship leasing programs shall be interviewed.

5. SCHEDULE:

A draft final report is required by September 30, 1982, with the final report published as soon as feasible after completion of review by OUSDRE. An interim report will be submitted by June 30, 1982. Interim informal progress briefings will be held as mutually agreed with the sponsor.

6. FUNDING:

The total cost of this task will be \$140,000.

7. TECHNICAL COGNIZANCE:

This study is sponsored by USDRE. Technical cognizance for the task is assigned to OUSDRE/Naval Warfare.

*Carl F. Romney*  
Robert S. Cooper  
Director

ACCEPTED: *Alexander H. Flax*  
Alexander H. Flax  
President, IDA

DATE: June 9, 1982

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## DESCRIPTION OF THE IDALEASE PROGRAM<sup>1</sup>

The IDALEASE computer program consists of the following subroutines which are called by the main program:

- PRESET - Sets default values of input variables 1-39.
- READ - Interactively reads in changes to be made in the default values.
- INITIAL - Initializes certain arrays and values in the program.
- PAYDEBT - Performs long-term debt calculations;
- CLOSEXP - Performs closing cost calculations;
- DEPREC - Performs ACRS and ITC calculations;
- OTHEXP - Performs other expense calculations;
- FLows - Pulls together the individual cost streams;
- MINLEAS - Calculates the minimum lease payment
- SINKFND - (Optional) Applies a sinking fund to the after-tax net-income stream when calculating the lease payment.
- TREASURY - Calculates the total cost to the Government (agency cost plus net Treasury costs).
- WRITE1 - Produces the table of input values and writes it to the TABLES file for print-out.
- WRITE2 - Produces a summary table and writes it to the TABLES file for print-out.
- SUMTAB - Produces a terminal display of the summary table.

Each subroutine is described below.

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<sup>1</sup>A complete write up of the program will appear in a forthcoming publication.

#### A. PRESET

To facilitate the input process, all input variables are set to default values. This is accomplished in this subroutine.

#### B. READ

The interactive process of changing the default values to the desired values is performed in this subroutine. When a run is finished and an additional case is to be processed, control returns to the READ subroutine. The values in the base (initial) case are now the default values. Whenever a change is made on a given run, these changes become permanent unless changed again in a new run.

#### C. INITIAL

The values of certain variables needed in the program are computed here, e.g.

- Total mortgage debt
- Total equity capital.

#### D. PAYDEBT

The results of the PAYDEBT subroutine appear in Table 3.<sup>1</sup> The subroutine first calculates the periodic (e.g. semi-annual) payment using the following formula:

$$\text{PAYMENT} = \frac{\text{rate} \times \text{DEBTCAP} \times (1+\text{rate})^n}{(1+\text{rate})^n - 1},$$

---

<sup>1</sup>The table numbers are those generated by the program.

# CASE IDENTIFICATION TEST

TABLE 3--PAYMENTS TO DEBT HOLDERS  
(THOUSANDS OF DOLLARS)

ANNUAL INTEREST RATE = 12.00000 PERCENT

PERIOD	INTEREST	AMORTIZATION	TOTAL	DEBT SERVICE
1	0.000	0.000	0.000	0.000
2	3600.000	1631.073	5231.073	0.000
3	0.000	0.000	0.000	0.000
4	3502.136	1728.938	5231.073	0.000
5	0.000	0.000	0.000	0.000
6	3398.399	1832.674	5231.073	0.000
7	0.000	0.000	0.000	0.000
8	3288.439	1942.635	5231.073	0.000
9	0.000	0.000	0.000	0.000
10	3171.881	2059.193	5231.073	0.000
11	0.000	0.000	0.000	0.000
12	3048.329	2182.744	5231.073	0.000
13	0.000	0.000	0.000	0.000
14	2917.365	2313.709	5231.073	0.000
15	0.000	0.000	0.000	0.000
16	2778.542	2452.531	5231.073	0.000
17	0.000	0.000	0.000	0.000
18	2631.390	2599.683	5231.073	0.000
19	0.000	0.000	0.000	0.000
20	2475.409	2755.664	5231.073	0.000
21	0.000	0.000	0.000	0.000
22	2310.069	2921.004	5231.073	0.000
23	0.000	0.000	0.000	0.000
24	2134.809	3096.264	5231.073	0.000
25	0.000	0.000	0.000	0.000
26	1949.033	3282.040	5231.073	0.000
27	0.000	0.000	0.000	0.000
28	1752.111	3478.963	5231.073	0.000
29	0.000	0.000	0.000	0.000
30	1543.373	3687.700	5231.073	0.000
31	0.000	0.000	0.000	0.000
32	1322.111	3908.962	5231.073	0.000
33	0.000	0.000	0.000	0.000
34	1087.573	4143.500	5231.073	0.000
35	0.000	0.000	0.000	0.000
36	838.963	4392.110	5231.073	0.000
37	0.000	0.000	0.000	0.000
38	575.437	4655.637	5231.073	0.000
39	0.000	0.000	0.000	0.000
40	296.098	4934.975	5231.073	0.000
TOTALS	44621.468	60060.000	104621.468	0.000

where rate = the periodic interest rate,  
DEBTCAP = total debt capital, and  
n = number of periods.

The routine then calculates the interest and principal payments to be made each period. The debt service charge is calculated by multiplying the debt payment by the debt service fee. The streams are then printed out as shown in Table 3.

In addition to these payout streams, the tax shelter streams for the interest and debt service expenses are calculated. In each case, the expenses are totaled by year and then divided into four quarterly deductions. The assumption here is that the lessor will figure his estimated taxes on a quarterly basis and will also take all estimated deductions on a quarterly bases.

#### **E. CLOSEXP**

Because the lease closing expenses are usually very large (one to three percent of the capital cost), it is assumed that part of the costs will be financed through a long-term loan at the long-term corporate interest rate. That portion which is not financed is added to equity, because the closing costs must be paid at the beginning of the period along with the equity payment.

As Table 4 indicates, the principal and interest on the loan are calculated in the same fashion as the long-term debt. The loan-interest tax shelter is divided into quarterly values.

The table also shows the tax shelter for the closing expenses. Current IRS guidelines indicate that for tax purposes these closing costs should be amortized over the life of the lease on a straight-line basis.



CASE IDENTIFICATION TEST

TABLE 4--PRINCIPAL, INTEREST AND DEDUCTIONS ON CLOSING COSTS

ANNUAL INTEREST RATE = 12.00000 PERCENT

THOUSANDS OF DOLLARS

PERIOD	PRINCIPAL	INTEREST	TOTAL PAYMENT	DEDUCTIONS-LOAN INT.	AMORTIZED CLOSING COSTS
1	0.	0.	0.	18.	25.
2	16.	36.	52.	18.	25.
3	0.	0.	0.	18.	25.
4	17.	35.	52.	18.	25.
5	0.	0.	0.	17.	25.
6	18.	34.	52.	17.	25.
7	0.	0.	0.	17.	25.
8	19.	33.	52.	17.	25.
9	0.	0.	0.	16.	25.
10	21.	32.	52.	16.	25.
11	0.	0.	0.	16.	25.
12	22.	30.	52.	16.	25.
13	0.	0.	0.	14.	25.
14	23.	29.	52.	14.	25.
15	0.	0.	0.	14.	25.
16	25.	28.	52.	14.	25.
17	0.	0.	0.	13.	25.
18	26.	26.	52.	13.	25.
19	0.	0.	0.	13.	25.
20	28.	25.	52.	13.	25.
21	0.	0.	0.	11.	25.
22	29.	23.	52.	11.	25.
23	0.	0.	0.	11.	25.
24	31.	21.	52.	11.	25.
25	0.	0.	0.	9.	25.
26	33.	19.	52.	9.	25.
27	0.	0.	0.	9.	25.
28	35.	18.	52.	9.	25.
29	0.	0.	0.	7.	25.
30	37.	15.	52.	7.	25.
31	0.	0.	0.	7.	25.
32	39.	13.	52.	7.	25.
33	0.	0.	0.	5.	25.
34	41.	11.	52.	5.	25.
35	0.	0.	0.	5.	25.
36	43.	8.	52.	5.	25.
37	0.	0.	0.	2.	25.
38	47.	6.	52.	2.	25.
39	0.	0.	0.	2.	25.
40	49.	3.	52.	2.	25.
TOTALS	0.	446.	1046.	446.	1000.

#### F. DEPREC

Tables 5 and 6 show the outputs of the DEPREC subroutine. These are simply the results of applying the Accelerated Cost Recovery System (ACRS) and the Investment Tax Credit (ITC) to the capital costs. Note that the streams are on a quarterly basis because they are tax shelters or credits.

Data statements in the subroutine contain the ACRS factors for all property classes; 3-year, 5-year, 10-year and 15-year.<sup>1</sup> A class may be selected optionally as a base case input or change.

#### G. OTHEXP

This subroutine handles the other expenses that may be inputted (see Table 7). It also determines the tax shelter stream.

#### H. FLOWS

At this point it will be helpful to introduce the general formula for obtaining the AFTER TAX NET INCOME (ATNI) stream. This is the stream which is used to obtain the lease payment. In general terms.

$$\begin{aligned} \text{ATNI} &= \text{NET INCOME} - \text{NET TAXES} \\ &= (I-E) - [(I-S)R-C] \end{aligned} \quad (1)$$

where,

I = Total income,  
E = Expense outlays,  
S = Tax shelters (tax deductible expenses),

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<sup>1</sup>Currently the factors are those specified under Section 206 of the "Tax Equity and Fiscal Responsibility Act of 1982"; as amended in 1983.

CASE IDENTIFICATION TEST

TABLE 5--CAPITAL RECOVERY STREAM  
(THOUSANDS OF DOLLARS)

DEPRECIATION METHOD	2
PPD ALLOCATION METHOD	2
CAPITALIZED COST	100000.
ALLOWABLE DEDUCTION	95000.

PERIOD	ACRS DEDUCTION
--------	----------------

1	3750.000
2	3750.000
3	3750.000
4	3750.000
5	5500.000
6	5500.000
7	5500.000
8	5500.000
9	5250.000
10	5250.000
11	5250.000
12	5250.000
13	5250.000
14	5250.000
15	5250.000
16	5250.000
17	5250.000
18	5250.000
19	5250.000
20	250.000
21	0.000
22	0.000
23	0.000
24	0.000
25	0.000
26	0.000
27	0.000
28	0.000
29	0.000
30	0.000
31	0.000
32	0.000
33	0.000
34	0.000
35	0.000
36	0.000
37	0.000
38	0.000
39	0.000
40	0.000

TOTAL	95000.000
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CASE IDENTIFICATION TEST

TABLE 6--INVESTMENT TAX CREDIT STREAM. ITC RATE = .10000  
(THOUSANDS OF DOLLARS)

PERIOD	ITC
1	2500.00
2	2500.00
3	2500.00
4	2500.00
TOTAL	10000.000

CASE IDENTIFICATION TEST

TABLE 7--OTHER EXPENSE PAYOUT AND DEDUCTION STREAMS  
(THOUSANDS OF DOLLARS)

PERIOD	PAYOUTS	DEDUCTIONS
1	0.000	0.000
2	0.000	0.000
3	0.000	0.000
4	0.000	0.000
5	0.000	0.000
6	0.000	0.000
7	0.000	0.000
8	0.000	0.000
9	0.000	0.000
10	0.000	0.000
11	0.000	0.000
12	0.000	0.000
13	0.000	0.000
14	0.000	0.000
15	0.000	0.000
16	0.000	0.000
17	0.000	0.000
18	0.000	0.000
19	0.000	0.000
20	0.000	0.000
21	0.000	0.000
22	0.000	0.000
23	0.000	0.000
24	0.000	0.000
25	0.000	0.000
26	0.000	0.000
27	0.000	0.000
28	0.000	0.000
29	0.000	0.000
30	0.000	0.000
31	0.000	0.000
32	0.000	0.000
33	0.000	0.000
34	0.000	0.000
35	0.000	0.000
36	0.000	0.000
37	0.000	0.000
38	0.000	0.000
39	0.000	0.000
40	0.000	0.000
TOTALS	0.000	0.000

R = Income tax rate, and  
C = Investment tax credit (if any).

Equation (1) above can be rewritten as follows

$$ATNI = I - IR - E + SR + C. \quad (2)$$

Note that the IR can be regarded as a gross estimate of income taxes before applying the tax credits. SR and C are the tax credits. Note further that E, SR and C are independent of the income level. The previous subroutines have calculated these values, and subroutine FLOWS pulls them together and puts them in the form needed to compute the lease payment.

Table 8 shows the calculation of the tax credit stream. The tax shelters (adjusted to quarterly payments) are added to give the "TOTAL ELIGIBLE EXPENSES" column. This is S in equation (2). The income tax rate, R, is applied to the eligible expenses to give the tax credit on the shelters (SR). The Investment Tax Credit (C) is added to give the "TOTAL TAX CREDITS" (SR+C) column.

Table 9 brings in the cash outlays, E. The payouts include the equity payment and the portion of closing costs which were not borrowed. These are paid at the beginning of the period. Amortization includes the amortization of the long-term debt as well as that of the borrowed closing costs. Similarly, debt interest includes both long-term debt interest and interest on borrowed closing costs.

Note that the last value of the "CASH OUTLAY" column is negative even though the expenses add up to a positive value. This is because the residual value of the asset is applied at the last period.

CASE IDENTIFICATION TEST

TABLE B--TAX CREDIT BREAKDOWN  
(THOUSANDS OF DOLLARS)

PERIOD	ACCELERATED CAPITAL RECOVERY	INTEREST EXPENSE	DEBT SERVICE	OTHER EXPENSES	TOTAL ELIGIBLE EXPENSES	TAX CREDIT ON ELIGIBLE EXPENSES	INVESTMENT TAX CREDITS	TOTAL TAX CREDITS
1	3750.000	1793.289	0.000	25.000	598.289	2561.413	2500.000	5061.413
2	3750.000	1793.289	0.000	25.000	598.289	2561.413	2500.000	5061.413
3	3750.000	1793.289	0.000	25.000	598.289	2561.413	2500.000	5061.413
4	3750.000	1793.289	0.000	25.000	598.289	2561.413	2500.000	5061.413
5	5900.000	1688.427	0.000	25.000	7213.427	3318.176	0.000	3318.176
6	5900.000	1688.427	0.000	25.000	7213.427	3318.176	0.000	3318.176
7	5900.000	1688.427	0.000	25.000	7213.427	3318.176	0.000	3318.176
8	5900.000	1688.427	0.000	25.000	7213.427	3318.176	0.000	3318.176
9	5250.000	1570.003	0.000	25.000	6853.003	3148.977	0.000	3148.977
10	5250.000	1570.003	0.000	25.000	6853.003	3148.977	0.000	3148.977
11	5250.000	1570.003	0.000	25.000	6853.003	3148.977	0.000	3148.977
12	5250.000	1570.003	0.000	25.000	6853.003	3148.977	0.000	3148.977
13	5250.000	1438.216	0.000	25.000	6713.216	3088.080	0.000	3088.080
14	5250.000	1438.216	0.000	25.000	6713.216	3088.080	0.000	3088.080
15	5250.000	1438.216	0.000	25.000	6713.216	3088.080	0.000	3088.080
16	5250.000	1438.216	0.000	25.000	6713.216	3088.080	0.000	3088.080
17	5250.000	1289.467	0.000	25.000	6504.467	3019.655	0.000	3019.655
18	5250.000	1289.467	0.000	25.000	6504.467	3019.655	0.000	3019.655
19	5250.000	1289.467	0.000	25.000	6504.467	3019.655	0.000	3019.655
20	250.000	1289.467	0.000	25.000	1584.467	719.655	0.000	719.655
21	0.000	1122.332	0.000	25.000	1147.332	527.773	0.000	527.773
22	0.000	1122.332	0.000	25.000	1147.332	527.773	0.000	527.773
23	0.000	1122.332	0.000	25.000	1147.332	527.773	0.000	527.773
24	0.000	1122.332	0.000	25.000	1147.332	527.773	0.000	527.773
25	0.000	934.539	0.000	25.000	959.539	441.388	0.000	441.388
26	0.000	934.539	0.000	25.000	959.539	441.388	0.000	441.388
27	0.000	934.539	0.000	25.000	959.539	441.388	0.000	441.388
28	0.000	934.539	0.000	25.000	959.539	441.388	0.000	441.388
29	0.000	723.535	0.000	25.000	748.535	344.326	0.000	344.326
30	0.000	723.535	0.000	25.000	748.535	344.326	0.000	344.326
31	0.000	723.535	0.000	25.000	748.535	344.326	0.000	344.326
32	0.000	723.535	0.000	25.000	748.535	344.326	0.000	344.326
33	0.000	486.450	0.000	25.000	511.450	235.267	0.000	235.267
34	0.000	486.450	0.000	25.000	511.450	235.267	0.000	235.267
35	0.000	486.450	0.000	25.000	511.450	235.267	0.000	235.267
36	0.000	486.450	0.000	25.000	511.450	235.267	0.000	235.267
37	0.000	220.063	0.000	25.000	245.063	112.729	0.000	112.729
38	0.000	220.063	0.000	25.000	245.063	112.729	0.000	112.729
39	0.000	220.063	0.000	25.000	245.063	112.729	0.000	112.729
40	0.000	220.063	0.000	25.000	245.063	112.729	0.000	112.729
TOTALS	95000.000	45067.083	0.000	1000.000	141067.083	64691.134	10000.000	74691.134

## CASE IDENTIFICATION TEST

TABLE 9--DETERMINATION OF NET CASH FLOW  
(THOUSANDS OF DOLLARS)

PERIOD	AMORTIZATION	DEBT INTEREST	DEBT SERVICE	OTHER EXPENSES	CASH OUTLAYS	TAX CREDITS	NET CASH FLOW
0	0.000	0.000	0.000	0.000	40400.000	5061.413	-40400.000
1	1647.384	3636.000	0.000	0.000	5283.384	5061.413	5061.413
2	0.000	0.000	0.000	0.000	0.000	5061.413	-221.971
3	0.000	0.000	0.000	0.000	0.000	5061.413	5061.413
4	1746.227	3537.137	0.000	0.000	5283.384	5061.413	-221.971
5	0.000	0.000	0.000	0.000	0.000	318.176	318.176
6	1831.881	3432.383	0.000	0.000	5283.384	318.176	-1963.208
7	0.000	0.000	0.000	0.000	0.000	318.176	318.176
8	1962.061	3321.323	0.000	0.000	5283.384	318.176	-1963.208
9	0.000	0.000	0.000	0.000	0.000	318.176	318.176
10	2079.785	3203.600	0.000	0.000	5283.384	318.176	-2134.407
11	0.000	0.000	0.000	0.000	0.000	318.176	318.176
12	2204.372	3078.813	0.000	0.000	5283.384	318.176	-2134.407
13	0.000	0.000	0.000	0.000	0.000	318.176	318.176
14	2336.846	2946.538	0.000	0.000	5283.384	318.176	-2134.407
15	0.000	0.000	0.000	0.000	0.000	318.176	318.176
16	2477.057	2806.327	0.000	0.000	5283.384	318.176	-2134.407
17	0.000	0.000	0.000	0.000	0.000	318.176	318.176
18	2623.080	2657.704	0.000	0.000	5283.384	318.176	-2134.407
19	0.000	0.000	0.000	0.000	0.000	318.176	318.176
20	2783.221	2500.163	0.000	0.000	5283.384	318.176	-2134.407
21	0.000	0.000	0.000	0.000	0.000	318.176	318.176
22	2950.214	2333.170	0.000	0.000	5283.384	318.176	-2134.407
23	0.000	0.000	0.000	0.000	0.000	318.176	318.176
24	3127.227	2156.137	0.000	0.000	5283.384	318.176	-2134.407
25	0.000	0.000	0.000	0.000	0.000	318.176	318.176
26	3314.841	1968.524	0.000	0.000	5283.384	318.176	-2134.407
27	0.000	0.000	0.000	0.000	0.000	318.176	318.176
28	3513.352	1768.832	0.000	0.000	5283.384	318.176	-2134.407
29	0.000	0.000	0.000	0.000	0.000	318.176	318.176
30	3724.377	1558.807	0.000	0.000	5283.384	318.176	-2134.407
31	0.000	0.000	0.000	0.000	0.000	318.176	318.176
32	3948.032	1335.332	0.000	0.000	5283.384	318.176	-2134.407
33	0.000	0.000	0.000	0.000	0.000	318.176	318.176
34	4184.835	1098.449	0.000	0.000	5283.384	318.176	-2134.407
35	0.000	0.000	0.000	0.000	0.000	318.176	318.176
36	4436.031	847.353	0.000	0.000	5283.384	318.176	-2134.407
37	0.000	0.000	0.000	0.000	0.000	318.176	318.176
38	4702.193	581.191	0.000	0.000	5283.384	318.176	-2134.407
39	0.000	0.000	0.000	0.000	0.000	318.176	318.176
40	4984.325	299.059	0.000	0.000	5283.384	318.176	-2134.407
TOTALS	60600.000	45067.683	0.000	0.000	146007.683	74891.134	-71176.549



The last step is to subtract the cash outlays from the tax credits to obtain the net flow before any income is generated. To understand this, note that equation (2) can be written:

$$\begin{aligned} \text{ATNI} &= (I-IR) + (SR+C-E) \\ &= (I-IR) + \text{NET CASH FLOW (before income)}. \end{aligned} \quad (3)$$

#### I. MINLEAS

This subroutine calculates the lease payment and other values needed for an analysis of the lease/purchase problem.

First, a trial payment is assumed. Using this trial payment, the after tax net income stream is generated as shown in Table 10.<sup>1</sup> The first column of this table shows the income generated from the trial lease payment. The next shows the interest earned while the payments are held by the indenture trustee. The total income (I) is the sum of the lease and interest incomes.

Next the gross income tax, IR, is calculated and distributed on a quarterly basis. This is subtracted from income to obtain the net income ("AFT. TAX INC.") before deducting the net cash flow calculated in FLOWS. In other words, at this point we have calculated the (I-IR) in equation (3) above.

The next column is the result when the net cash flow is added to the (I-IR). This, finally, is the AFTER TAX NET INCOME generated from the trial payment and net cash flow.

The next step is to calculate the present value of this ATNI stream. The formula is

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<sup>1</sup>This table is for the last iteration, but intermediate tables may be generated optionally to show the progress of each iteration.

CASE IDENTIFICATION TEST

TABLE 10--INCOME STREAMS GENERATED BY MINIMUM LEASE PAYMENT

(THOUSANDS OF DOLLARS)

MINIMUM LEASE PAYMENT= 7332.829 PAID 2 TIMES PER YEAR

MINIMUM RATE OF RETURN = 12.00000 PERCENT

PERIOD	LEASE INCOME	INTEREST	INC	TOTAL INCOME	EST INC	TAX	AFT. TAX	INC AFT. TAX	TAX NET	AFT SINK	NET DISCOUNTED	NET
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-10400.000	-40400.000	-40400.000	
1	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	3374.862	3374.862	3374.862	3280.587	
2	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	5424.307	5424.307	5424.307	5125.408	
3	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	3374.862	3374.862	3374.862	3099.863	
4	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	5424.307	5424.307	5424.307	4843.131	
5	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1031.626	1031.626	1031.626	1416.133	
6	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	3481.070	3481.070	3481.070	3105.611	
7	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1631.626	1631.626	1631.626	1338.101	
8	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	3481.070	3481.070	3481.070	2934.327	
9	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1462.427	1462.427	1462.427	1132.270	
10	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	3311.071	3311.071	3311.071	2645.413	
11	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1462.427	1462.427	1462.427	1070.840	
12	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	3311.071	3311.071	3311.071	2499.681	
13	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1401.529	1401.529	1401.529	969.714	
14	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	3450.974	3450.974	3450.974	2321.018	
15	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1401.529	1401.529	1401.529	916.293	
16	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	3450.974	3450.974	3450.974	2193.156	
17	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1333.104	1333.104	1333.104	823.545	
18	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	3382.549	3382.549	3382.549	2031.248	
19	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1333.104	1333.104	1333.104	778.177	
20	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1082.549	1082.549	1082.549	614.267	
21	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1158.778	1158.778	1158.778	639.194	
22	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	890.667	890.667	890.667	477.947	
23	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1158.778	1158.778	1158.778	602.944	
24	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	890.667	890.667	890.667	451.239	
25	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1245.163	1245.163	1245.163	613.216	
26	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	804.282	804.282	804.282	305.027	
27	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1245.163	1245.163	1245.163	379.439	
28	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	804.282	804.282	804.282	263.816	
29	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1342.225	1342.225	1342.225	590.194	
30	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	707.220	707.220	707.220	302.287	
31	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1342.225	1342.225	1342.225	537.861	
32	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	707.220	707.220	707.220	285.634	
33	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1451.283	1451.283	1451.283	509.775	
34	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	598.161	598.161	598.161	228.279	
35	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1451.283	1451.283	1451.283	538.387	
36	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	598.161	598.161	598.161	215.703	
37	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1373.822	1373.822	1373.822	531.682	
38	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	475.623	475.623	475.623	162.866	
39	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	1373.822	1373.822	1373.822	541.291	
40	7332.829	0.000	0.000	7332.829	1000.551	1000.551	-1000.551	475.623	475.623	475.623	153.138	
TOTALS	146656.576	0.000	0.000	146656.576	67462.029	79194.551	79194.551	8018.002	8018.002	8018.002	1024	

$$PV = \sum_{i=1}^n \frac{ATNI_i}{(1+r)^i} \quad (4)$$

where

$r$  = the lessor's required after tax rate of return per period.

This present value is then compared to the EQUITY payment made by the lessors including the non-borrowed portion of the closing costs. If the present value of ATNI calculated under (4) above minus the equity payment equals zero, the payment is the minimum that the lessor would accept and still obtain the desired rate of return. Actually, as a practical matter, a range is set for this difference; i.e., if the absolute difference is less than a value specified in the inputs, the payment is accepted as minimum. In this case the difference was 1.0.

As an alternative test the subroutine calculates the absolute difference between the payment in the previous iteration and the present iteration. If this difference is less than a specified input value, the payment is accepted.

Returning to Table 10, note that this is the final calculation of the ATNI for the accepted payment of 2831.891 (\$Thousands). The last column shows the discounted ATNI with the sum of -.013 at the bottom. The column headed "AFT SINK NET" will be explained below.

The last step in the subroutine is to calculate the summary values shown in Table 2. In particular, the present value of the lease payment stream paid by the agency is:

$$PV = \sum_{i=1}^n \frac{P_i}{(1+D)^i},$$

where

$P_1$  = the lease payment in period 1, and

D = discount rate used for calculating Government costs.

The discount rate used here should not be confused with the lessor's after tax rate of return used in calculating the lease payments which may be substantially higher.

#### J. SINKFND<sup>1</sup>

This subroutine is an optional subroutine that may be used in MINLEAS. Note in Table 10 that the ATNI (third column from the left) has many negative values, especially toward the end of the stream. These are payments which must be paid by the earlier positive values in the stream. In some cases, a sinking fund may be required to accumulate funds to make these payments.

The SINKFND subroutine draws just enough funds from the positive values toward the latter portion of the stream to pay off the negative values. Each positive value selected draws interest at a rate specified by input.

In Table 10, the "AFT SINK NET" column is the ATNI after the sinking fund is applied. This becomes the stream used in the iterative process described above. In the example, the sinking fund option was not used; thus the before-sinking-fund and after-sinking-fund columns are identical. If the sinking fund option is not used, the lessor covers the negative payments by income invested at the lessor's after tax rate of return. This is equivalent to using a sinking fund interest rate equal to the lessor's rate of return.

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<sup>1</sup>Not shown in main program. This subroutine is called in MINLEASE.

## K. TRESURY

This subroutine uses Method I to calculate the total cost to the Government of leasing a single unit on a period (e.g. quarterly) basis as shown in Table 11.<sup>1</sup> Discounted costs are also calculated. Total cost to the Government is calculated as follows:

Lease Payment (Cost to the agency)

ADD: Revenue Losses for Lessor Tax Credits

- Accelerated Cost Recovery (ACRS)
- Investment Tax Credit (ITC)
- Mortgage Interest
- Other Expenses

Deduct Revenue Gains from Lessor/Lendors/Other Taxes

- From Lease Payments (Lessor)
- From Interest Income (Lendors)
- From Others

It is important to note that the income tax rate for the lessors (equity holders) may differ from the income tax rate of the lenders of long-term funds (mortgage holders). This is because the latter may consist of non-profit institutions and/or individuals with smaller tax rates than the typical corporate tax rate. As Table 1 indicates, these two tax rates are separate input values and are treated separately in the program.

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<sup>1</sup>Method II costs are calculated in a separate program.

## CASE IDENTIFICATION TEST

TABLE 11--BREAKDOWN OF NET COST TO THE GOVERNMENT  
(THOUSANDS OF DOLLARS)

PERIOD	LEASE PAYMENT	ACPS	ITC	MORTGAGE INTEREST	OTHER EXPENSES	TOTAL LOSS OF REVENUE	LESSOR TAXES	MORTGAGE INTEREST	OTHER SOURCES	TOTAL GAIN OF REVENUE TO GOVERNMENT	TOTAL COST
1	0.	1725.	2500.	817.	20.	9081.	1687.	817.	20.	2523.	2538.
2	7333.	1725.	2500.	817.	20.	12394.	1687.	817.	20.	2523.	9871.
3	0.	1725.	2500.	817.	20.	9081.	1687.	817.	20.	2523.	2538.
4	7333.	1725.	2500.	817.	20.	12394.	1687.	817.	20.	2523.	9871.
5	0.	2530.	0.	769.	19.	3318.	1687.	769.	19.	2475.	843.
6	7333.	2530.	0.	769.	19.	10651.	1687.	769.	19.	2475.	8176.
7	0.	2530.	0.	769.	19.	3318.	1687.	769.	19.	2475.	843.
8	7333.	2530.	0.	769.	19.	10651.	1687.	769.	19.	2475.	8176.
9	0.	2415.	0.	715.	19.	3149.	1687.	715.	19.	2421.	728.
10	7333.	2415.	0.	715.	19.	10482.	1687.	715.	19.	2421.	8061.
11	0.	2415.	0.	715.	19.	3149.	1687.	715.	19.	2421.	728.
12	7333.	2415.	0.	715.	19.	10482.	1687.	715.	19.	2421.	8061.
13	0.	2415.	0.	655.	18.	3088.	1687.	655.	18.	2360.	728.
14	7333.	2415.	0.	655.	18.	10421.	1687.	655.	18.	2360.	8061.
15	0.	2415.	0.	655.	18.	3088.	1687.	655.	18.	2360.	728.
16	7333.	2415.	0.	655.	18.	10421.	1687.	655.	18.	2360.	8061.
17	0.	2415.	0.	587.	17.	3020.	1687.	587.	17.	2291.	728.
18	7333.	2415.	0.	587.	17.	10352.	1687.	587.	17.	2291.	8061.
19	0.	2415.	0.	587.	17.	3020.	1687.	587.	17.	2291.	728.
20	7333.	2415.	0.	587.	17.	10352.	1687.	587.	17.	2291.	8061.
21	0.	112.	0.	511.	17.	528.	1687.	511.	17.	2214.	5646.
22	7333.	0.	0.	511.	17.	7861.	1687.	511.	17.	2214.	5646.
23	0.	0.	0.	511.	17.	528.	1687.	511.	17.	2214.	5646.
24	7333.	0.	0.	511.	17.	7861.	1687.	511.	17.	2214.	5646.
25	0.	0.	0.	426.	16.	441.	1687.	426.	16.	2128.	5646.
26	7333.	0.	0.	426.	16.	7774.	1687.	426.	16.	2128.	5646.
27	0.	0.	0.	426.	16.	441.	1687.	426.	16.	2128.	5646.
28	7333.	0.	0.	426.	16.	7774.	1687.	426.	16.	2128.	5646.
29	0.	0.	0.	330.	15.	344.	1687.	330.	15.	2031.	5646.
30	7333.	0.	0.	330.	15.	7677.	1687.	330.	15.	2031.	5646.
31	0.	0.	0.	330.	15.	344.	1687.	330.	15.	2031.	5646.
32	7333.	0.	0.	330.	15.	7677.	1687.	330.	15.	2031.	5646.
33	0.	0.	0.	222.	14.	239.	1687.	222.	14.	1922.	5646.
34	7333.	0.	0.	222.	14.	7568.	1687.	222.	14.	1922.	5646.
35	0.	0.	0.	222.	14.	239.	1687.	222.	14.	1922.	5646.
36	7333.	0.	0.	222.	14.	7568.	1687.	222.	14.	1922.	5646.
37	0.	0.	0.	100.	13.	113.	1687.	100.	13.	1799.	5646.
38	7333.	0.	0.	100.	13.	7446.	1687.	100.	13.	1799.	5646.
39	0.	0.	0.	100.	13.	113.	1687.	100.	13.	1799.	5646.
40	7333.	0.	0.	100.	13.	7446.	1687.	100.	13.	1799.	5646.
TOTALS	146637.	43700.	10000.	20326.	665.	221546.	67462.	20326.	665.	88653.	132895.

#### L. WRITE1

This subroutine generates Table 1. The table contains the values of all inputs for a specific case.

#### M. WRITE2

This subroutine generates a summary table containing the undiscounted and discounted total costs and other items of general interest (see Table 2).

#### N. SUMTAB

This subroutine produces a terminal display of the summary table (Table 2).

#### O. OTHER SUBROUTINES

There are three additional subroutines other than SINKFND which are not called by the main program, but are called internally by other subroutines.

##### 1. DISPLAY (KOPT)

This subroutine produces a terminal display of the input values. KOPT=1 displays variables 1-20. KOPT=2 displays variables 21-39. KOPT=3 displays the print options. The option values are set in subroutine READ in response to the questions asking whether the variables are to be displayed.

##### 2. PRINTOPT (NTAB, NOPT)

This subroutine changes the values of the default print options in response to questions addressed in the interactive part of the run. It involves a computed GO TO process which resets the value of the print option for a given table number, NTAB, and the option selected, NOPT.

# CASE IDENTIFICATION TEST

```

# TABLE 1-- VALUES OF VARIABLES 1-39.#
# #
# 1 ACQUISITION COST ($ THOUSANDS) PER UNIT # 100000.
# #
# 9 NUMBER OF YEARS IN THE LEASE # 10
#10 ACCOUNTING CYCLE (TIMES PER YEAR) # 4
#11 FREQUENCY OF DEBT PAYMENTS PER YEAR # 2
#12 FREQUENCY OF PAYMENTS TO EQUITY HOLDERS # 2
#13 FREQUENCY OF LEASE PAYMENTS PER YEAR # 2
#14 FREQUENCY OF COMPOUNDING SHORT-TERM INT. # 364
# #
#15 PROPORTION OF COST IN LONG-TERM MORTGAGE # .6
#16 LONG-TERM INTEREST RATE # .12
#17 SHORT-TERM INTEREST RATE # .1
#18 DISCOUNT RATE FOR GOVERNMENT COST # .1
#19 EQUITY HOLDERS RATE OF RETURN # .12
#20 SINKING FUND RATE OF RETURN # .12
#21 SINKING FUND OPTION ( 1 YES, 0 NO) # 0
#22 DEBT SERVICE FEE PER PERIOD (PROPORTION) # 0.
# #
#23 ACRS CLASS CODE (1 3-YEAR,2 5-YEAR) # 2
#24 PROPORTION OF COST APPLIED TO ACRS # 1.
#25 INVESTMENT TAX CRED (PROPORTION) # .1
#26 NUMBER OF ITC PERIODS # 4
#27 INCOME TAX RATE FOR EQUITY HOLDERS # .46
#28 INCOME TAX RATE FOR MORTGAGE HOLDERS # .46
# #
#29 OTHER EXPENSES, INITIAL PERIOD # 0.
#30 TERMINATION EXPENSES # 0.
#31 RESIDUAL VALUE OF UNIT # 0.
#32 CLOSING COSTS(PROPORTION OF CAP. COSTS) # .01
#33 PROPORTION OF CLOSING COSTS BORROWED # .6
#34 INTEREST RATE ON BORROWED CLOSING COSTS # .12
# #
#35 INITIAL HIGH VALUE FOR LEASE PAYMENT # 99900.
#36 INITIAL LOW VALUE FOR LEASE PAYMENT # 0.
#37 SQUEEZE LIMITS,LEASE PAYMENT DIFFERENCE # .001
#38 SQUEEZE LIMITS,DISCOUNTED SUM DIFFERENCE # .05
#39 MAXIMUM NUMBER OF ITERATIONS # 50

```



TEST

TABLE 2--SUMMARY OF UNDISCOUNTED AND DISCOUNTED COSTS  
DISCOUNT RATE = 10.000 PERCENT  
(THOUSANDS OF DOLLARS)

ITEM	UNDISCOUNTED	DISCOUNTED
ACQUISITION COST	100000.	
TERM OF LEASE IN YEARS	10	
LEASE PAYMENT PAID 2 TIMES PER YEAR	7333.	
ANNUAL LEASE PAYMENT	14666.	
TOTAL LEASE COST TO AGENCY	146657.	92313.
TOTAL LEASE COST TO GOVERNMENT	132895.	93092.

### 3. CHANGE (NVAR, VALUE)

This subroutine changes the default values of the input variables in response to entries during the interactive part of the run. It involves a computed GO TO process which resets the value, VALUE of a given variable, NVAR. This is done automatically in response to the prompting.

Appendix C

NINE TANKER BUILD-AND-CHARTER PROGRAM EQUITY  
AND LENDING PARTICIPANTS

**NINE TANKER BUILD-AND-CHARTER PROGRAM EQUITY  
AND LENDING PARTICIPANTS**

The lists of original equity participants and bond purchasers were obtained from Reference [5]. Of course, participation may have changed during the course of the implementation of the program due to various portfolio adjustments by the institutions. However, the lists provide an example of the kinds of institutions that were interested in the financing of naval ships at that time. Because of the tax benefits currently available, it would be expected that a greater variety of profit-making firms would be interested in entering the lease arrangement.

Table C-1. NINE TANKER BUILD-AND-CHARTER  
PROGRAM EQUITY PARTICIPANTS

1. American Road Equity Corporation, The American Road,  
Dearborn, Michigan 48121.
2. Citicorp Leasing, Inc., 399 Park Avenue, New York, New  
York 10022.
3. First National Bank in Dallas, P.O. Box 6031, Dallas,  
Texas 75222.
4. First National Bank of Minneapolis, 120 South Sixth  
Street, Minneapolis, Minnesota 55480.
5. First Hawaiian Bank, 161 South King Street, Honolulu,  
Hawaii 96801.
6. First National Bank of Montgomery Corp., 2 Commerce  
Street, Montgomery, Alabama 36104.
7. Ohio National Bank of Columbus, 51 North High Street,  
Columbus, Ohio 43216.
8. State Street Bank and Trust Company, 225 Franklin Street,  
Boston, Massachusetts 02101.
9. South Carolina National Bank, P.O. Box 168, Columbia,  
South Carolina 29202.
10. Virginia National Bank, 1 Commercial Place, Norfolk,  
Virginia 23510.
11. Wilmington Trust Company, 100 West 10th Street, Wilmington,  
Delaware 19899.
12. Manufacturers National Bank of Detroit, 151 West Fort  
Street, Detroit, Michigan 48226.
13. The Third National Bank and Trust Company of Dayton, Ohio,  
34 North Main Street, Dayton, Ohio 45402.
14. Union Trust Company, 310 Main Street, Stamford,  
Connecticut 06904.

**Table C-2. BUILD-AND-CHARTER PROGRAM BOND  
PURCHASERS**

1. The Prudential Insurance Company of America, Prudential Plaza, Newark, New Jersey 07101.
2. Teacher Retirement System of Texas, Austin, Texas 78701.
3. Aid Association for Lutherans, Appleton, Wisconsin 54911.
4. Benjamin Franklin Federal Savings and Loan Association of Portland, 517 Southwest Stark Street, Portland, Oregon 97204.
5. Bowery Savings Bank, 110 East 42nd Street, New York, New York 10017.
6. The Life Insurance Company of Virginia, P.O. Box 27601, Richmond, Virginia 23261.
7. The National Life and Accident Insurance Company, National Life Center, Nashville, Tennessee 37203.
8. State Treasurer of the State of Michigan, Custodian of Michigan Public School Employees', Retirement Systems Funds, c/o State Treasurer, P.O. Box 810, Lansing, Michigan 48903.
9. Liberty National Life Insurance Company, P.O. Box 2612, Birmingham, Alabama 35202.
10. American National Insurance Company, One Moody Plaza, Galveston, Texas 77551.
11. The New York Bank for Savings, 280 Park Avenue South, New York, New York 10010.
12. Los Angeles County Employees Retirement Association, 437 Hall of Administration, 500 West Temple Street, Los Angeles, California 90012.

13. American United Life Insurance Company, P.O. Box 368,  
One West 26th Street, Indianapolis, Indiana 46206.
14. Dollar Savings Bank, P.O. Box 987, Pittsburgh,  
Pennsylvania 15230.
15. Teachers' Retirement System of Kentucky, 309 Lewis  
Street, Frankfort, Kentucky 40601.
16. Nationwide Life Insurance Company, 246 North High Street,  
Columbus, Ohio 43216.
17. Northwestern National Life Insurance Company, P.O. Box 20,  
Minneapolis, Minnesota 55440.
18. Southwestern Life Insurance Company, P.O. Box 2699,  
Dallas, Texas 75221.
19. Treasurer, State of Iowa, Custodian and Trustee for  
Iowa Public Employees' Retirement System, c/o State  
House, Des Moines, Iowa 50319.
20. Brooklyn Savings Bank, Fulton and Montague Streets,  
Brooklyn, New York 11201.
21. The Independent Order of Foresters, 789 Don Mills Road,  
Don Mills, Ontario, Canada.
22. Confederation Life Insurance Company, 321 Bloor Street  
East, Toronto, Ontario, Canada.
23. Continental Illinois National Bank and Trust Company of  
Chicago (not individually but as trustee of Trust No.  
58532), 231 South La Salle Street, Chicago, Illinois  
60604.
24. Horace Mann Life Insurance Company, One Horace Mann  
Plaza, Springfield, Illinois 62715.
25. Knights of Columbus (a corporation), Columbus Plaza,  
New Haven, Connecticut 06507.
26. The Lincoln National Life Insurance Company, 1301 South  
Harrison Street, Ft. Wayne, Indiana 46801.
27. Lutheran Brotherhood, 701 Second Avenue South, Minneapolis,  
Minnesota 55402.
28. Occidental Life Insurance Company of California, P.O. Box  
2101 Terminal Annex, Los Angeles, California 90054.

29. The Ohio National Life Insurance Company, P.O. Box 237, Cincinnati, Ohio 45201.
30. State of Montana, State House, Capitol Building, Helena, Montana 59601.
31. The Union Central Life Insurance Company, P.O. Box 177, Cincinnati, Ohio 45201.
32. Western & Southern Life Insurance Company, 400 Broadway, Cincinnati, Ohio 45201.
33. Fidelity Life Association, c/o Supervised Investors Services, Inc., 120 South La Salle Street, Chicago, Illinois 60603.
34. Federal Kemper Life Assurance Company, c/o Supervised Investors Services, Inc., 120 South La Salle Street, Chicago, Illinois 60603.
35. Guarantee Reserve Life Insurance Company, c/o Supervised Investors Services, Inc., 120 South La Salle Street, Chicago, Illinois 60603.